

A Cloud-Based Approach to Data Collection & Project Management for Architectural Conservation

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Think, believe, dream and dare. - W.D.

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- Patrick J. Caughey

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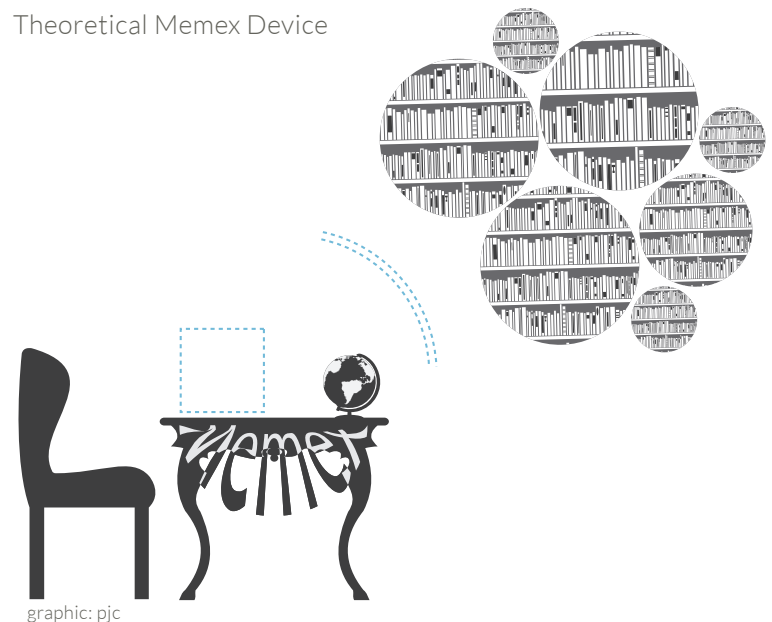
Preface | The Evolution of an Idea: Memex to Tablets

1945

In his 1945 essay “As We May Think,” American scientist Vannevar Bush outlined his idea of a Memex, an electronic device linked to virtual libraries capable of storing and serving information of varying formats to an operator in physical space. He predicted that “wholly new forms of encyclopedias will appear, ready made with a mesh of associative trails running through them, ready to be dropped into the Memex and there amplified.” His prediction led to the creation of hypertext programming languages and the first widely accessible wide area network, the ARPANET.¹

¹ O'Regan, G. (Springer-Verlag London Limited 2008). A Brief History of Computing. Springer. 180

Illustration: Vannevar Bush's Theoretical Memex Device



graphic: pjc

Tablet computers and smart-phone devices are as ubiquitous today as Jimmy Hendrix and Don McLean records were in 1969. And like American Pie, tech-heavy rhetoric and touch-screen interfaces illustrate a far greater movement of technological and social transformation, one that continues to mature with respect to global communications and liberated information.

The subtle complexities that comprise the information age are in one way or another all proceeded by an idea, an idea of what could be within the boundless possibilities of future technologies. Today, we can see that what began as an idea many years ago in the minds of people like Bush and Berners-Lee has since matured into previously unforeseeable realities that affect the very ways in which we live our individual and collective lives. Though we cannot predict what the technology of tomorrow will bring, we can be certain that the ideas we have today will in one way or another affect its development and eventual application.

One | Introduction

The fundamental purpose of conservation is to ensure the transmission of our cultural heritage to those who follow us, its significant messages intact and accessible to the greatest degree possible.

- Sir Bernard M. Fieldman, former director of ICCROM

Significance is the defining characteristic of architectural heritage.* It comes as a consequence of understanding the historical, cultural, and geographical contexts surrounding structures and landscapes. Historical, cultural, and geographical contexts are understood through the historical record, documented events marking social, political, and anthropological moments in time. Thus the path to understanding significance begins at the source, with the production of the historical record.

Architectural professionals responsible for curating the passage of architectural heritage from one generation to another have an obligation to ensure records of their actions, interventions, decisions, and interpreta-



* Architectural Heritage: The collective ensemble of existing buildings, both the celebrated and the ordinary.

tions are produced and preserved for future generations. Such records* contribute invaluable information to the historical record,** they allow future generations to understand what it is we value and something of their origins.^{III}

The benefits of producing consistent and reliable records throughout the entire architectural project process is not only for posterity's sake, however. Immediate benefits of responsible recording include significantly improved project planning, encouraged (if not forced) interdisciplinary communication, well-informed clients and project team members, and, of course, the ability to evaluate project decisions and resulting outcomes in real time. The potential savings in unnecessary overhead costs associated with poor document management alone make such efforts worthwhile. But if we combine our efforts to produce and preserve architectural project records for future generations with a best-practice methodology of project evaluation, we can go further.

If we apply the basic notion of project evaluation to current and completed projects from around the world, via some kind of portal or window through which pools, or sets, of architectural project data may be accessed and evaluated thereafter by international communities, then over time the potential impact of analyzing and learning from both inter-

* Record(s): Units of information used to describe the history of a place and/or the rationale behind decisions and/or actions affecting a given project's outcome. Units of information include building documents such as plans, elevations, sections and details; local planning data such as historical or landmark designation reports; material analyses data such as structural analyses of masonry or steel frame construction; or design schemes and proposals that illustrate future plans for existing structures and landscapes. Records also include documents of a much larger scale, such as entire buildings or cultural heritage objects.

** The Historical Record: A collection of records providing reference to past social, political, and anthropological moments in time.

III Clark, K. (2001). *Informed Conservation: Understanding Historic Buildings and their Landscapes for Conservation*. English Heritage, pp.7

national and intergenerational collections of architectural project data will be nothing less than transformative. Through a simple database query an architectural professional could research all projects of a particular type, region, condition and requirement. He or she could locate all precedents that may support or refute local ordinances or building codes preventing a project from moving forward. He or she could familiarize themselves with historical trends in architectural, engineering and construction projects so they may in turn forecast local development patterns in urban or rural developments, as to prepare themselves or their firms for inevitable shifts in building-trade economics. Effectively, once collected, managed and made widely available, such collections of AEC project data becomes available for a multitude of applications; some familiar to us today, and certainly, some that are not.

Though the thought of such a resource is indeed an idealistic one, we have access to certain tools and technologies that make it possible. To help us learn more about the kinds of tools and technologies that are necessary, and to discover how, exactly, we as architectural professionals may deploy them, we'll take a look at a brief example from an industry not so dissimilar from our own.

In 2011, researchers from Harvard University, MIT, the American Heritage Dictionary, the Encyclopedia Britannica and Google Incorporated took five-million digitized texts and publications, with publication dates spanning nearly two centuries (right illustration), and ana-

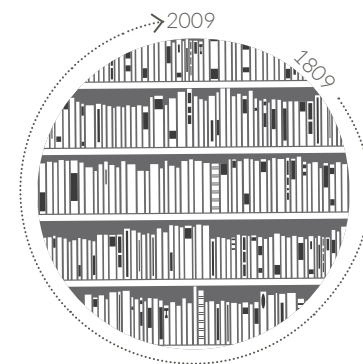


Illustration: Five million digitized texts and publications spanning two centuries.

lyzed trends in, among other things, the evolution of syntax, semantics and diction.^{IV} Surely this has little to do with the production and analysis of architectural project data, but consider this: what made [their] study particularly interesting was the prodigious amount of data, digitized historic records, that they were able to filter, sort and analyze. And in doing so, they revealed evolutionary trends and patterns in cultural linguistics that otherwise would have gone unnoticed.

The implications of their findings reach far beyond grammatical factoid. The source of content [in this case] was so comprehensive and so arbitrarily inclusive, that the resulting analyses painted a clearer, more intimate picture of the authors and readers of historical literature that, until recently, was either distorted by a bias history or simply wasn't known at all. If we, as architectural professionals – or professionals of any field for that matter – begin to think about what we could gain from this kind of analytical approach to such a vast array of architectural projects (right illustration), authored by both current and proceeding generations, we will find not only is there much we can learn from the projects of our past, but we can simultaneously secure reliable and widely accessible records for generations to come; allowing them in turn to do the same.

Now, to be clear, I am not talking about online journals or architectural magazines; rather, I am very specifically talking about international col-

IV “What We Learned From Five Million Books” http://www.ted.com/talks/what_we_learned_from_5_million_books.html

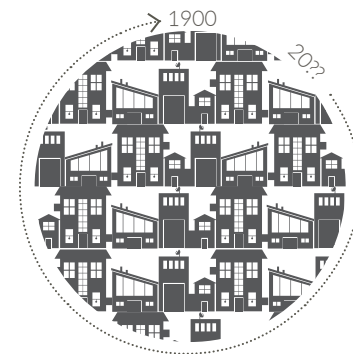


Illustration: Hypothetical database of projects involving architectural heritage.

lections of records produced from real projects: building documents, correspondence, proposals, bids, presentations, etc (right illustration). Records that illustrate the nature and rationale behind project decisions that in turn illustrate the context and personality of entire projects. Indeed, as this topic concerns not only data collection on a massive scale, but also project management within digital work-environments (not to mention establishing standard methods for digital documentation), it can begin to expand very quickly. Consequently, this thesis will be limited in its scope.

The discussion concerning the application of *collected* architectural project data will be confined to little more than introduction. I intentionally leave it to the imagination of the reader and broader audience to consider their own use and application of such data *after* the fact. Therefore, this thesis will concern itself with the methods required to collect and manage architectural project data before it is made available to international communities. This is the first and most essential step toward establishing an international repository of architectural project information; it must be taken carefully. Without a sound structure to collect and withstand the pressures of international information, both physical with respect to technological limitations and political with respect to security and cost, the system will remain confined to the state of an unrealized idea.

That said, the accumulation and management of international architec-

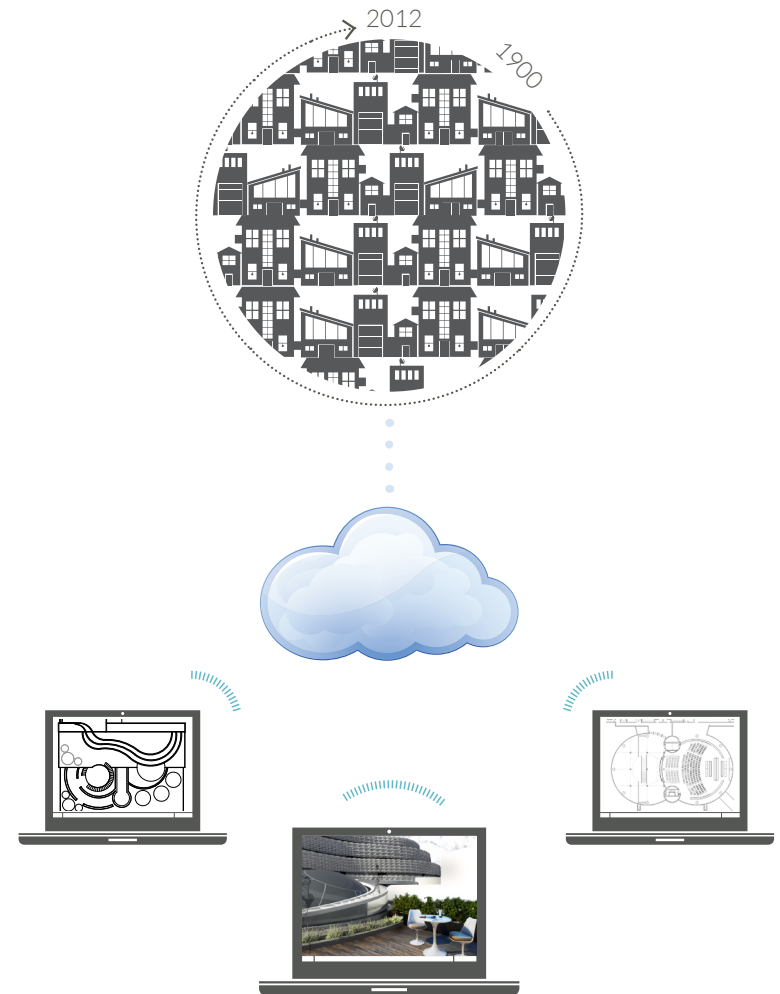


Illustration: Hypothetical database of projects involving architectural heritage, accessible via world wide web.

tural project data is possible. The first and most essential step toward making it so must be taken by those interacting with architectural heritage, specifically: archaeologists, architects, architectural conservators, architectural historians, engineers, material scientists, historic preservationists and city and urban planners. It must be taken by all professionals who are responsible for the development and protection of new and historic built environments. This thesis will present a cloud-based approach to data collection and project management for architectural conservation that is designed to help working professionals take the first step to establish a widely accessible database of architectural information.

The chapters and sections that follow will explore two fundamental challenges associated with data collection and project management within the context of architectural conservation. It will look at three separate international best-practice guidelines for recording, documentation and information management that collectively apply to all stages of architectural conservation work, setting baseline standards for international project collaboration. Finally, it will demonstrate how cloud-based collaboration and project management systems will bring internationally accepted standards of recording, documentation and information management to local and national architectural conservation efforts; simultaneously laying the groundwork for the gradual process of collecting and managing project information for the purpose of establishing an international database of architectural heritage information.

Two | Records & References: The Challenges Associated with Producing, Collecting and Managing Records Relating to Architectural Conservation

Architectural professionals produce records of their work on a daily basis. Such records illustrate rationale behind the types of decisions affecting the outcome of entire projects -- design decisions, legal decisions, planning decisions, etc. These records can be enormously helpful to those who are not directly involved in a given project. They help others understand the context, and thus the significance, of a structure and its surrounding environment.

When archived and preserved appropriately, project records become invaluable resources for architectural professionals carrying out future work. That said, it may be assumed that a high degree of cooperation between current architectural organizations is common place; the benefits of sharing information and having open access to inventories of completed projects are obvious. But ironically, the tendency within many architectural organizations is to not share in-house data, or to invest in

reliable methods of data sharing.^V Records produced from a given project are rarely shared with neighboring organizations, much less openly with the public.

The tendency to withhold project records is the result of two fundamental challenges faced by architectural professionals. The first challenge is that any existing international standards for recording, documentation and information activities within the multidisciplinary professions of architectural conservation are either unknown or out-dated. Without international and consistent standards for such activities within architectural work, that are both reliable and widely accessible, the multidisciplinary and generational gaps separating working professionals widen beyond a reasonable span, hindering interdisciplinary communication and collaboration within local, national and international architectural projects.

The second challenge is that architectural conservation, like all professions within the architectural, engineering and construction industries, is governed by cost; without immediate return on investment professionals simply cannot afford to invest in new technologies on the basis of cultural or ethical obligation alone. If architectural organizations and working professionals are to willingly share project information, there

^V Letellier, R. (2007). *Recording, Documentation, and Information Management for the Conservation of Heritage Places: Guiding Principles*. Los Angeles California: The Getty Conservation Institute. p.47

must be valuable incentive for them to do so.

Therefore, before an international inventory of architectural heritage information can even begin to develop, working professionals must universally accept that the gradual, collective return on their invested participation, as well as the availability of international architectural heritage information, are valuable in and of themselves. The following chapters will explore these challenges and their proposed solutions in detail, but first, there are two important considerations that apply to the broader notions of data collection and project management within the context of architectural conservation that require a brief introduction.

Consideration # 1: What is Architectural Data?

We must ask ourselves what, exactly, *is* data? What does it look like? What form(s) can it take? Where does it come from, how is it collected, stored, and interpreted? It is an essential task to differentiate between raw data extracted from the field (i.e., pure, un-formatted and un-manipulated information existing within the structure, landscape or object as standing reserve), and the managed, manipulated, presentation formats the professional puts them in later on (i.e., BIM models, DWG drawings, JPEG images, animated presentations, etc.). If the two can be separated – raw* from manipulated** – data may take any form the professional would like, insofar as the messages and content within are successfully transmitted to and understood by the end user. This is very important



Image: Curran O'Toole Building, New York, NY. Source: Patrick J. Caughey

* Existing buildings inherently contain raw data. All materials, systems, designs, etc., are present within the building. The building is a physical database of its own raw information.

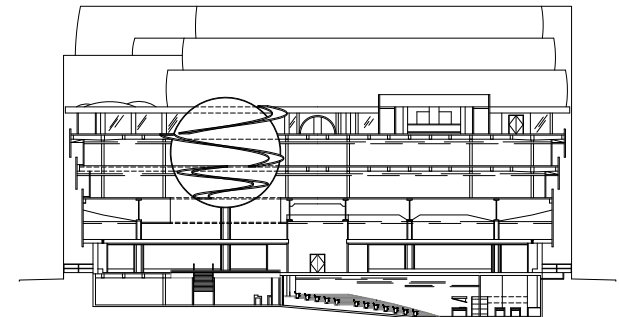


Image source: Historic Preservation Studio II: Curran O'Toole Adaptive Reuse, Patrick J. Caughey

** When data is extracted from the building and placed within 'human-readable' formats, such as construction documents, building models, or image presentations, it is manipulated to fulfill a communicative purpose.

for interdisciplinary *and* intergenerational communication as formats of manipulated data constantly change (i.e., traditional building documents represented in Autodesk's native .dwg file format compared to the more contemporary .rvt file format - Autodesk's Building Information Modeling platform).

Consideration # 2: Where and from Whom does Information Come?

The obvious prerequisite for an inventory of architectural information is to identify its source. In the Google Book Library project (mentioned in chapter one), Google Inc. had two key advantages of having open access to intellectual and physical content that was not protected by copyright or trademark laws, and a source of content that was literally waiting on the shelves for them to check out and return when finished. Architectural information - in both regards - is quite the opposite.

Architectural information is dynamic and multidisciplinary. It is constantly being extracted from buildings and sites, and constantly flowing in and out of architectural offices and organizations. If an international inventory of usable and meaningful records of architectural information is to form, records must be dynamically extracted in real-time as they arise from a given project. The successful collection of such records is dependant upon a degree of participation, as well as a willingness to contribute on behalf of the architectural professional.

* * *

With these two fundamental challenges and prerequisite considerations in mind, the following chapter will review three publications from three separate international cultural and architectural heritage management organizations contributing to the discussion surrounding the development of consistent standards for architectural conservation -- the first primary challenge faced by architectural professionals resulting in the tendency to withhold project records. The standards and methods presented in the following chapter will be incorporated into the computational back-end framework of *The Heritage Project* web- and desktop-application; a cloud-based solution to the second primary challenge (presented above) that will be introduced in chapter five, and outlined in detail in chapter six.

Three | Existing Standards for Documentation: Council of Europe, the Getty Conservation Institute & English Heritage

1) Council of Europe: *Guidance on Inventory and Documentation of the Cultural Heritage*

In 2001, the Council of Europe and the *Ad Hoc* Group for Inventory and Documentation within the Technical Co-operation and Consultancy Programme published *Guidance on Inventory and Documentation of the Cultural Heritage*. *Guidance on Inventory* is a guiding document based on best practices of heritage recording and documentation taking place within member sites of the Council of Europe, on experience gained within the Technical Co-operation and Consultancy Programme of Europe, and on a number of succeeding international heritage charters and conventions prior to its authorship.^{VI}

The supporting conventions and charters include the European Convention on the Protection of the Archaeological Heritage of 1969,

VI Council of Europe, C. o. (2001). *Guidance on Inventory and Documentation of the Cultural Heritage*. pp. 9

the Amsterdam Declaration of 1975, the Granada Convention of 1985, the Malta Convention of 1992, and the resolutions of the fourth European Conference of Ministers for the Cultural Heritage in 1996.^{VII} The latter “emphasized the need to develop further integrated conservation mechanisms by incorporating the cultural heritage within a process of sustainable development”, placed particular attention on globally accessible and internationally significant cultural heritage, and on “the study, documentation and preservation of cultural assets as ‘authentic evidence of the history and culture of human civilization.’”^{VIII}

The *Ad Hoc* Group for Inventory and Documentation within the Technical Co-operation and Consultancy Programme was established to develop and publish a call to action for all professionals working with the architectural heritage to establish widely-accessible electronic inventories of heritage information. In addition to supporting their thesis with sound evidence and reason for inventories, and for understanding the role of inventories within architectural heritage, they include in their publication three internationally approved standards for heritage documentation.

The three standards re-published in *Guidance on Inventory* are: *the Core Data Index to Historic Buildings and Monuments of the Architectural Heritage*, *the Core Data Standard for Archaeological Sites and Monuments*, and *the*

VII *Guidance on Inventory*, 9

VIII *Guidance on Inventory*, 10

Core Data Standard for Identifying Cultural Objects – Object ID. These standards were approved by international committees “on the basis that they do not require organizations to collect information they would otherwise not collect, or seek to make users conform to systems that are incompatible with their own needs.”^{IX} They define heritage objects and data categories that are regarded as “indispensable for proper cultural heritage management.”^X While the latter two standards apply to archaeological sites and moveable objects respectfully, *the Core Data Index to Historic Buildings and Monuments of the Architectural Heritage* is specific to identifying records and inventories of architectural heritage projects.

The Core Data Index to Historic Buildings and Monuments of the Architectural Heritage^{*} is a documentation standard based on the minimum level of information needed to describe a building, monument or site for the sole purposes of identification.^{XI} It is described as a key building block in the development of information networks that allow diverse organizations to exchange meaningful descriptions of heritage objects clearly and rapidly. While its basic structure and specified input variables are based on digital data systems, the types of information it specifies apply broadly to both traditional (non-digital) and contemporary (digital) information management systems.

IX *Guidance on Inventory*, 11

X *Guidance on Inventory*, 12

XI *Guidance on Inventory*, 12

^{*} Section 1, *Names and References*, sub-sections 1.1 - 1.5.1 of *the Core Data Index to Historic Buildings and Monuments of the Architectural Heritage* with amended examples from the author of this thesis.

1: Names and References

1.1: Name of Building

Example: The Curran O’Toole Building

1.2: Unique Reference Number - The number or combination of characters which uniquely identifies each building recorded by the organization.

Example: AH_10025

1.3: Date of Compilation - Date of compilation of the core data index record. This date may be modified whenever the index record is updated.

Example: 2012-04-02T18:52:08+0000 (Dynamic Timestamp)

1.4: Recording Organization - Name of the organization responsible for curating the record.

Example: Architectural Heritage, LLC

1.5: Cross Reference to Related Building Records - This enables cross referencing to related records, enabling, for example, the relating of a building record to its wider complex record.

Example: Adaptive Reuse Project represented as AR

1.5.1 Qualifier of Relationship - This field indicates the type of relationship between one recorded structure and another, such as a hierarchical “parent-child” relationship linking a building complex (e.g., Monastery) and an individual building (e.g., Church).

Example: Hospital to Public Building

2) The Getty Conservation Institute: *Recording, Documentation and Information Management for the Conservation of Heritage Places: Guiding Principles*

Between 1995 and 1999, the International Committee for Documentation of Cultural Heritage (CIPA) sought to identify gaps in the fields of heritage recording, documentation, and information management, particularly between professionals who provide information for conservation projects and those who ultimately use it. In response to their identifications, the Internal Council on Monuments and Sites (ICOMOS), the Getty Conservation Institute (GCI), and CIPA implemented the RecorDIM initiative. The purpose of the RecorDIM initiative was to bring conservation information users and providers together to identify the nature of the gaps between them, to develop strategies to close those gaps, and to illustrate how those strategies may be formulated into a project-framework that could be applied and tested concurrently within active heritage place conservation projects around the world.^{XII}

The result of the RecorDIM initiative was the Getty Conservation Institute's 2007 publication, *Recording, Documentation and Information Management for the Conservation of Heritage Places: Guiding Principles*. It was compiled from material authored by one of the principal contribu-

XII Letellier, 7

tors to the RecorDIM initiative, Robin Letellier, and included additional contributions from Werner Schmid and Francois LeBlanc. Its companion text, *Illustrated Examples*, presents a series of case-studies resulting from the proposed framework presented in *Guiding Principles*.

Guiding Principles

Guiding Principles is a compilation of twelve principles for conservation professionals to use as guidelines throughout all conservation projects ensuring appropriate and consistent levels of recording and documentation, with resulting records that are appropriately managed and stored. The first five guiding principles address: 1) why good information management should take place, 2) at which point it becomes most essential in particular projects, 3) identifying individuals who should carry out heritage information activities, 4) who carries responsibility, and 5) where, exactly, diverse heritage information activities fit into the overall conservation process.^{XIII}

The conservation process, as Letellier and his contributors illustrate it, is a hierarchical project framework delineating typical phases that apply to all heritage place conservation projects. It is defined as “the informed decision-making process, which ensures that conservation at all levels will respect the values and significance of the cultural heritage

XIII Letellier, xvii

place.”^{XIV} When combined with their working definitions of Research and Investigation, defined as, “a variety of activities aimed at the acquisition of information pertinent to increasing knowledge of a cultural heritage place,”^{XV} **six distinct phases of the heritage place conservation** process are formed.

The Six Phases of the Heritage Place Conservation Process

Recording, documentation and information management of heritage places are “essential activities in all phases of the conservation process and should be fully integrated.”^{XVI} It is essential that the output, or end results from recording, documentation and information management within each phase of the conservation process be kept in a centralized location and wholly managed as part of an integrated project dossier.^{XVII} *Guiding Principles’* six-phase process ensures complete integration and appropriate handling of all project data produced and collected throughout a heritage place conservation project. Each phase within the conservation process has a clearly defined beginning and end; before moving from one phase to the next, project managers and administrators must decide whether or not the project has fulfilled the criteria of the current

XIV Letellier, 21

XV Letellier, 21

XVI Letellier, xvii

XVII Letellier, xvii

phase. If not, the team is to go back and finish the phase before moving on.

The following summarizes the six phases and ideal output values of the conservation process as they are presented in *Recording, Documentation and Information Management for the Conservation of Heritage Places: Guiding Principles*.

Phase One – Initiation

“Is there a good reason or opportunity to conserve the heritage place?”

The purpose of the Initiation phase is to analyze the need, problem, or opportunity within the heritage place. It is during the Initiation phase that all project stakeholders, internal and external, meet and establish the initial goals and objections for the project’s future. Letellier stresses that all decisions made during the Initiation phase be recorded before moving on to the next phase of the project.

The ideal output of the Initiation phase should include all past reports that are relevant to the heritage place, photographic surveys illustrating current conditions, sketched plans, designation reports, zoning information, etc. The records and documents collected during this phase should be kept in a central repository of project information and remain accessible throughout all succeeding phases of the heritage place project.^{XVIII}

XVIII Letellier, 23

Phase Two – Assessment

“What do we really have, and what condition is it in?”

The goal of the Assessment phase is to take a closer look at the relevant context and significance of the heritage place, to try to understand the state of its physical condition and - if one is in place - the current heritage management system. Critical at this stage, Letellier argues, is the availability of all existing records and documentation pertinent to the overall understanding of the heritage place, including bibliographic and archival surveys, accurate measured drawings, photographs, thematic maps, condition reports, scientific data, historical and archaeological maps, analysis samples, etc. This collected material should add depth and understanding to the records and documents acquired and produced during the Initiation phase. Cumulatively, the records compiled in phase one and two should provide a comprehensive understanding of the heritage place so all decisions made thereafter are well-informed and respectful of the site’s significance.^{XIX}

Phase Three – Options

“What choices do we have?”

The purpose of the Options phase is to study and test multiple conservation and management plans, to prepare cost-estimates, and to update project schedules. The output of the Options phase ideally include

XIX Letellier, 24

detailed as-found records of the heritage place, expert and specialist reports & analysis of current conditions, cost estimates, presentation models, and any other documents and records related to the options presented in this phase. Letellier and his contributors emphasize the importance of being exhaustively thorough in considering all possible options before moving on to the fourth phase, Project Development.^{XX}

Phase Four – Project Development

“How can we turn the best option into a final project?”

The purpose of the Project Development phase is to take the best option produced from the Options phase and mature it into a fully developed and defined project. During this phase, construction drawings, specifications, refined budgets and project schedules, and other legal documents relevant to the finalized project, are produced and are stored in the central repository of project information. The documents and contracts produced during the Project Development phase will allow the project to evolve on to the fifth phase, Implementation.^{XXI}

Phase Five – Implementation

“How can we realize this project?”

The purpose of the Implementation phase is to physically carry out the

XX Letellier, 24

XXI Letellier, 25

conservation work developed throughout the proceeding four phases of the project process. “Implementation involves putting into action all the research and planning efforts conducted in the previous phases.” During the Implementation phase, professionals, contractors, and specialists execute conservation activities according to the documents prepared up and to this point. The ideal output of the Implementation phase include as-built drawings and documents, thematic maps geographically recording where varying treatments were applied, photographic presentations, project diaries, progress reports, maintenance manuals and samples of conservation materials. The end of the Implementation phase marks a completed project.^{XXII}

Phase Six – Operation

“How can we ensure the long-term sustainability of this cultural resource and how should project information be managed?”

The purpose of the sixth phase is to address how the long-term sustainability of the heritage-resource can be ensured, and how heritage managers can maintain on-going monitoring and evaluation of the heritage place. During the Operation phase, a maintenance program should be set in place. The maintenance program should be accompanied by maintenance manuals, monitoring strategies, and a comprehensive report of the entire conservation process. This report should be stored and

XXII Letellier, 25

saved in a central project archive and remain available for future reference. “This phase generates ongoing operational, monitoring and maintenance activities. When a new need, problem, or opportunity arises, the [heritage place conservation process] begins anew.”^{XXIII}

Guiding Principles | Six through Twelve

Guiding principle six seeks to understand the first planning step of any heritage place project, *research*. Before any new documents or records are produced from a conservation project, all existing documentation and information must be collected and reviewed. Guiding principle seven asserts that collected heritage records accurately identify the heritage place, its contextual and significant relationships, its physical condition, history of maintenance and repairs, political status, and any threats or risks to its safekeeping.^{XXIV}

Guiding principle eight addresses the level of commitment that is needed from decision makers throughout the process of conserving heritage places. It states, “the commitment to conserve heritage places requires an equal commitment to acquiring heritage information by establishing clear policies for recording, documentation and information management activities, as well as guidelines and standards for defining, planning,

XXIII Letellier, 25

XXIV Letellier, 33

and implementing recording, for archiving all records, and for information exchange and dissemination.”^{XXV} Guiding principle nine through eleven build on principle eight, and collectively address who should have access to acquired information, the level of detail that is required within the collected information, what scope, level, and methods should apply to the acquisition of information, and finally, what formats are most appropriate for storing collected information. Guiding principle twelve emphasizes the additional care and consideration that must go into the storage and archival protocols when using digital formats. Using universal formats, such as PDF, HTML, XML, TXT, RTF, ANSI I, and keeping regular backups of all project information are highly recommended.^{XXVI}

Guiding Principles | Summary

The twelve guiding principles proposed by Letellier, Schmid, and LeBlanc provide sound guidance on methods of recording, documentation and information management that are flexible and applicable within all generalized phases of projects involving the conservation of heritage places. However, while their methods are progressive and indeed promising, they are incomplete.

Letellier and his contributors concede there are problems and difficul-

XXV Letellier, 34

XXVI Letellier, 46-49

ties associated with establishing widely accessible information centers for heritage places – and indeed there are many. While the solutions provided to the problems and difficulties associated with shared repositories of heritage information are sound for the time of *Guiding Principles*' publication, the methods and digital standards that comprise much of their rationale are either dated or flawed with respect to the necessary back-end architectural requirements of high-performance, scalable servers. Nevertheless, the heritage place conservation process and guiding principles presented by Letellier, Schmid and LeBlanc provides a suitable framework from which a contemporary and widely-accessible project management system can form.

3) English Heritage: Informed Conservation

Kate Clark's 2001 English Heritage publication, *Informed Conservation, Understanding Historic Buildings and their Landscapes for Conservation*, is a guiding text on best practice techniques for understanding buildings and their landscapes through the Conservation-Based Research and Analysis (CoBRA) approach to conservation.^{XXVII} CoBRA is defined as:

“ The research, analysis, survey and investigation necessary to understand the significance of a building and its landscape, and thus inform decisions about repair, alteration, use and management. ”

The ultimate goal of CoBRA is to understand and define the significance of a building and its landscape. Clark argues that “understanding is not a luxury – all conservation depends upon a clear understanding of what matters, and why.”^{XXVIII}

Clark presents CoBRA, both broadly and specifically, within seven sections (collectively presented as guidelines) that are intended to “help all those who already provide conservation advice to be clearer about when and where information can be useful.” The seven sections include: 1) why understanding is central to conservation, 2) how much information

XXVII Clark, 9

XXVIII Clark, 9

is needed, 3) tailoring information requirements to specific projects, 4 & 5) deal with the use of understanding for different types of conservation projects, 6) conservation management plans, and 7) specific analytical techniques that can be used to understand significance.

The first chapter of *Informed Conservation* is heavily focused on the role and importance of understanding context and significance in conservation work. To set the tone and approach to *Informed Conservation*, Clark recounts,

“ Conservation advisers are not there to stand in the way of change, but to negotiate the transition from the past to the present in ways that minimize the damage that change can cause, and maximize the benefit... Conservation is thus a process which seeks to both question change and to reconcile modern needs with the significance of what we have inherited in order to safeguard the interests of future generations.

”

Clark goes on to explain why understanding is fundamental to all processes of conservation. Conservation professionals cannot protect or curate heritage they do not understand. She argues that understanding “has to be an integral part of the design process” and that it “must stem from an appreciation of what is special about the place.” A well-established understanding of significance informs all aspects of good,

informed conservation.^{XXIX}

Chapters two through six address many of the same best-practice methods and standards covered in Letellier's *Guiding Principles*. It is worth noting, however, that the primary difference between their respective reasoning is that while Letellier places the conservation process within a project-management framework (the Heritage Place Conservation Process), Clark applies a guiding methodology (CoBRA) to the conservation process*. The methods of recording, documentation and information management, are largely the same. Chapter seven presents the analytical techniques that may be used for the purposes of understanding buildings and landscapes. This chapter is of particular interest and will be discussed in detail in the following section.

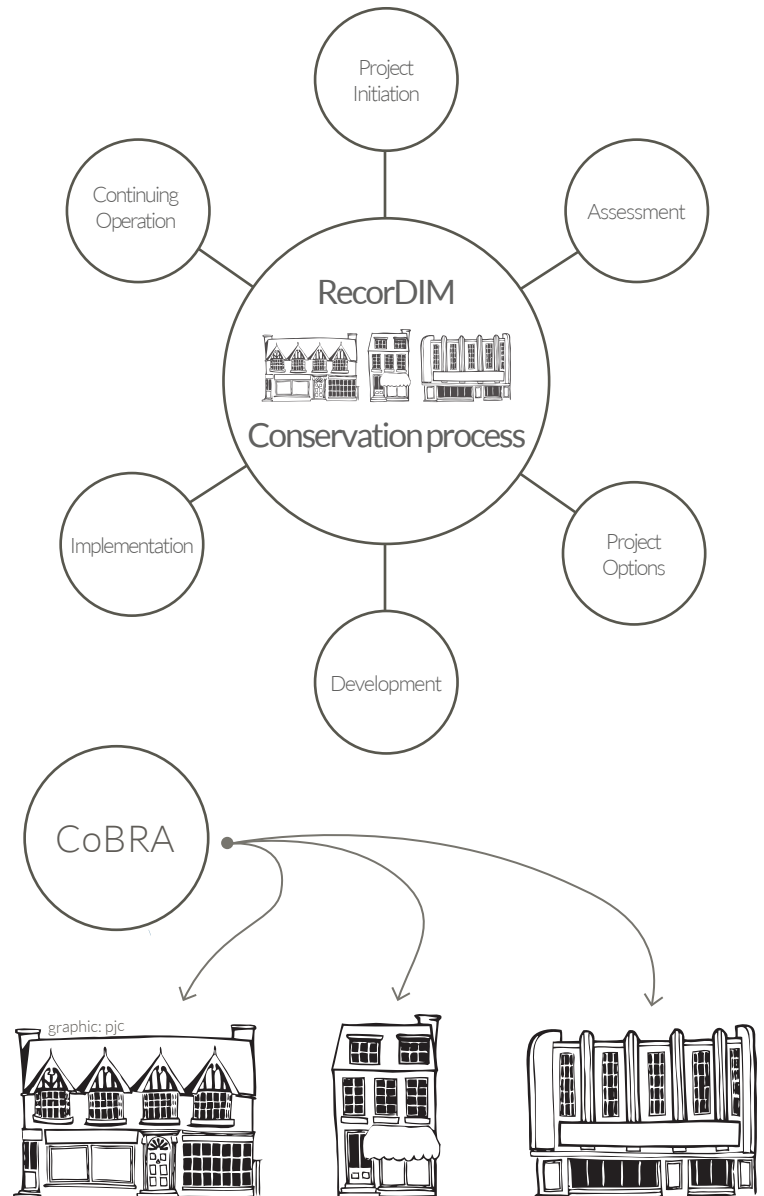
Analytical Techniques for Understanding Buildings and Sites

Informed conservation activities depend on understanding the significance of the architectural heritage. Understanding must “also be explicit, otherwise it is difficult to communicate with others or to proceed in a responsible way.”^{XXX} The level of understanding “should meet appropriate academic standards, and take place within a wider research framework”^{XXXI} as well. There are a number of analytical tools profes-

XXIX Clark, 12-13

XXX Clark, 13

XXXI Clark, 73



* Guiding Principles Six-Phase Conservation Process and Kate Clark's Conservation-Based Research and Analysis Approach to Conservation Projects

sionals may use to attain this level of understanding.

Historical Research

Letellier and Clark both emphasize the importance of extensive and thorough historical research early in the conservation process. This approach often yields a greater understanding of the building and landscape's development over time. Research is invaluable to any and all conservation projects involving the architectural heritage. Clark stresses that the primary focus of historical research should be toward map regression, historic photographs, newspapers, periodicals, or other formats or databases containing information pertinent to the historic record of the building and landscape.

Survey and Analysis

Once the context and history of a building is known, it is important for the conservation professional – and all contributing members of the project team – to begin taking field notes, producing rough sketches and plans that help communicate initial findings and ideas. As the project moves forward, the project team should produce measured surveys of the building (plans, elevations, sections, etc.), image based surveys (photogrammetric, orthographic, rectified photography) and measured site surveys using a range of digital and non-digital tools.

Analytical Drawings

As conservation efforts begin to narrow on the details of the building and its landscape, the project team should begin to produce phasing plans and models that depict the transformation of the building and its landscape over time. Phasing models and/or diagrams may take form in plans, elevations, sections, axonometric or orthographic perspectives. Or, depending on project resources, animated presentations can be very effective in illustrating the dynamisms of a site and its landscape.

Typologies

It is important to distinguish between building typologies and architectural styles. Photography, sketched plans and academic resources can help conservation professionals and interested individuals understand the progression and layering of typologies that have accrued over time within buildings and landscapes.

Defining Significance: Reports

Clear and concise written reports are an essential part of Clark's CoBRA process. Reports "ensure that information is communicated to other professionals working on the project, and also ensure that information is there for future management of the building."^{xxxii} A successful and

xxxii Clark, 98

complete report, Clark states, is clear and easy to read, is illustrated with relevant illustrations, contains clear and sound arguments, acknowledges areas of on-going research and uncertainty, and facilitates “further research by identifying any gaps, asking questions, and clearly referencing sources.”^{XXXIII}

Informed Conservation | Summary

The ultimate goal of Clark’s CoBRA approach to buildings and sites is to understand why and how buildings and their landscapes came to be, and to define the ever-evolving significance within. The intention of the guidelines within Informed Conservation, Clark states, “is to help all those who already provide conservation advice to be clearer about when and where information can be useful...” “Ultimately,” she says, “understanding is not a luxury – all conservation depends on a clear understanding of what matters, and why.”^{XXXIV}

XXXIII Clark, 98

XXXIV Clark, 9

Four | Review & Critique

1) Review

We have just reviewed three publications authored by three separate international heritage management organizations advocating for the development and implementation of both best-practice guidelines and guiding-principles within international architectural heritage and conservation projects. To recap, those publications were: the *Core Data Index to Historic Buildings and Monuments of the Architectural Heritage*, which was included in the Council of Europe's publication, *Guidance on Inventory and Documentation of the Cultural Heritage*; the Getty Conservation Institute's *Recording, Documentation and information Management for the Conservation of Heritage Places: Guiding Principles*; and English Heritage's *Informed Conservation*.

The *Core Data Index to Historic Buildings and Monuments of the Architectural Heritage* provides internationally agreed upon documentation standards for identifying core components of a given project for the sole purposes of identification. Its syntactic guidelines and core data values collectively serve as a sound solution for identifying project databases within an

international inventory of architectural heritage information.

In the Getty Conservation Institute's *Recording, Documentation and Information Management for the Conservation of Heritage Places: Guiding Principles*, Robin Letellier and his contributors, Werner Schmid and Francois LeBlanc, proposed a project-management framework defined as the Heritage Place Conservation Process. The Conservation Process, as Letellier and his contributors illustrate it, is a hierarchical project framework delineating typical project phases and their respective desired output that apply broadly to all heritage place conservation projects. The six individual phases that comprise the process are: Initiation, Assessment, Options, Project Development, Implementation and Operation. In addition to the Conservation Process, the Getty Publication outlined in detail twelve principles that collectively provide sound guidance on methods of recording, documentation and information management that are both flexible and applicable within all generalized phases of projects involving the conservation of heritage places.

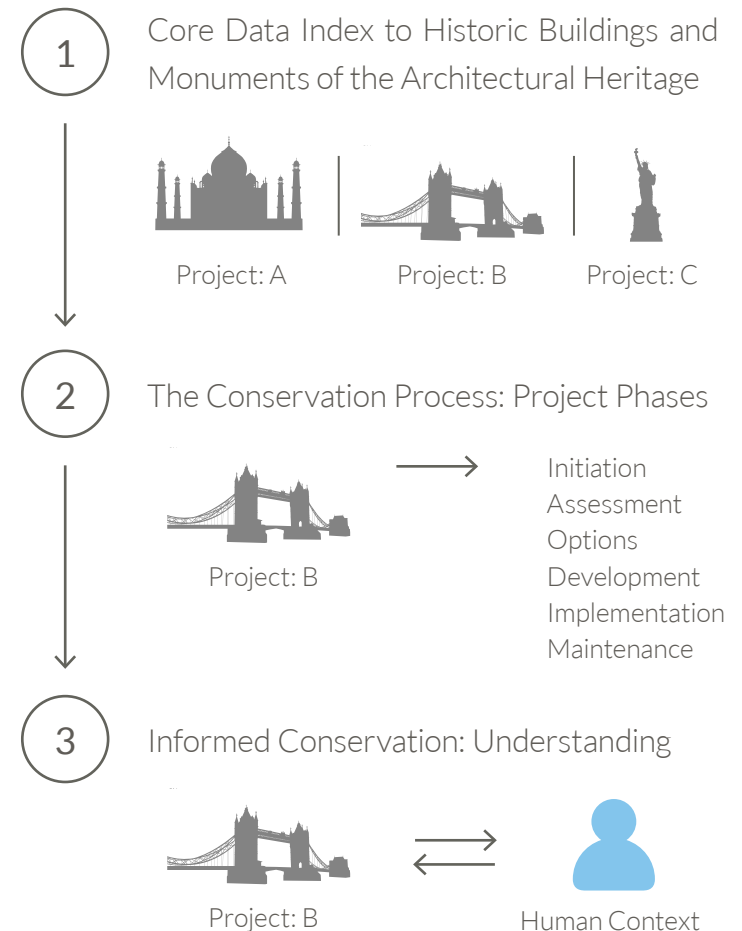
In *Informed Conservation: Understanding Historic Buildings and their Landscapes for Conservation*, Kate Clark proposed the Conservation-Based Research and Analysis (CoBRA) approach to a diverse array of conservation activities pertaining to historic buildings and landscapes. In chapter seven of *Informed Conservation*, Clark outlines essential analytical tools and methods used to attain a clearer understanding of significance and thus be more able to make the necessary decisions that affect historic buildings and their landscapes. The ultimate goal of Clark's CoBRA approach to buildings and sites is to understand why and how buildings

and their landscapes came to be, and to define the ever-evolving significance within them.

The three publications covered up and to this point provide suitable documentation and recording standards that will place the foundation from which a cloud-based data collection and project management system for architectural conservation can be built. *Guidance on Inventory* initiates the construction process by providing the standard method for identifying individual projects within an international database. *Recording, Documentation and Information Management for the Conservation of Heritage Places: Guiding Principles* takes over the structural framing efforts by providing the project framework: the Heritage Place Conservation Process which facilitates the dynamic relationships between those collecting information and those who will ultimately use it. Finally, *Informed Conservation: Understanding Historic Buildings and their Landscapes for Conservation* begins to define the overall function and purpose by providing a flexible method of approach to an array of conservation activities, setting the baseline standards for analyzing collections of information for the purposes of understanding human context, and thus significance (see illustration at right)

2) Critique

In chapter two of this thesis, *Records & References: The Challenges Associated with Producing, Collecting and Managing Digital Records of Architectural*



Conservation, we reviewed two primary challenges that result in architectural conservation organizations' tendency to avoid investing in new information management and sharing systems. Those challenges were: 1) existing international standards for recording, documentation and information management activities within the multidisciplinary professions of architectural conservation, are either unknown or out-dated. Without international and consistent standards for such activities within architectural work – that are both reliable and widely accessible – the multidisciplinary and generational gaps separating individual working professionals widen beyond a reasonable span, hindering interdisciplinary communication and collaboration within local, national and international architectural projects. And 2) architectural conservation, like all professions within the broader architectural, engineering and construction-management industries, is governed by cost; without immediate return on investment, professionals simply cannot afford to invest in new technologies on the basis of cultural or ethical obligation alone.

The documentation standards discussed in chapter three fail to address the means by which the guidelines and guiding-principles are incorporated into architectural professionals' already well-established habits of documentation. Furthermore, without defining a reliable and very powerful medium through which working professionals may access these standards, the professional is not only without incentive to conform their in-house operations to standards that are largely inaccessible, they are burdened with the expectation to seek out and adopt the recommended guidelines on their own accord. This is not to say the standards them-

selves are flawed; rather, the means by which professionals are supposed to access them, and the missing incentive for them to do so, is what renders the Getty's, Council of Europe's and English Heritage's systems ineffective on a scale that is necessary to affect the global community. To address these issues, we turn to the familiar world of BIM modeling, and the less-familiar worlds of cloud-based computing and information technology. Before going any further, however, we must define what, exactly, we mean by cloud-based computing and information technology.

Cloud-based computing is a term often used to describe computational processes taking place within cloud-based environments, or simply *the cloud*. The use of the term cloud with respect to internet and information technology is often associated with digital services or networks that operate somewhere between the sky above our heads and the outer-bounds of Earth's atmosphere. This is a false, albeit, intended association that has gained a great deal of attention simply because it falls within the negligent philosophy of "out-of-sight, out-of-mind." In short, cloud-<insert word here> is a marketing term that refers to computational services provided by vast server farms located in various cluster-sites around the world. Despite the proprietary software and configuration, the servers within such facilities are no different than the server(s) in your firm's back office.

Information technology, often abbreviated as IT, refers to both physical and non-physical networking technologies. Physical technologies include things such as network cables (cat-5 or cat-6), file servers, which include disc-drives, random-access-memory (RAM) cards, CPUs and motherboards, and network devices, such as routers, modems, switches, etc.

Non-physical network technologies include operating systems, such as Linux Ubuntu or Windows Server, firewalls, network configuration and monitoring programs, etc. Essentially, information technology refers to the technology and program configuration that go into computer networks and network development. It is an enormously broad category of computer science and deserves far more attention than I will be giving it here. For our intents and purposes, however, you should know that when I refer to information technology, I am referring to networks, servers and bandwidth (the rate of data transfer between two or more physical devices). Alright, back to the subject of interest: the critique

The publications presented in chapter three of this thesis cumulatively provide a viable solution to challenge number one; however, they collectively and individually fail to address the second challenge: the means by which their published standards are to be distributed to and adopted by the international professional in both a reasonable and cost-effective way. Now, if we look back once more to chapter two of this thesis, *Records & References*, the two challenges restated above were prefaced by two considerations of data collection and project management within the context of architectural conservation. Those considerations were: 1) understanding the difference between raw and manipulated data, and 2) understanding where and from whom the data will come.

All three publications presented in chapter three of this thesis discuss the role of digital technology in architectural projects, and in one way or another glaze over the considerations listed above. *Guidance on Inventory* describes the underlying form and input methods for the *Core Data Index*.

Robin Letellier and his contributing authors present their unique PID method, which includes a series of digital questioners and input forms accessible through an online interface. Kate Clark talks about an array of digital tools and applications available to architectural professionals carrying out field and as-found condition surveys. However, all three fail to discuss the underlying back-end technological architecture that is required to support the front-end applications they allude to in their respective arguments. Thus if we are going to design a secure, reliable and widely-accessible system for architectural project information that incorporates their standards, we must first understand the basic operations of its computational back-end. The operations of interest are easily understood when compared to a tool many architectural professionals are familiar with.

3) The ~~BIM~~ PIM Alternative

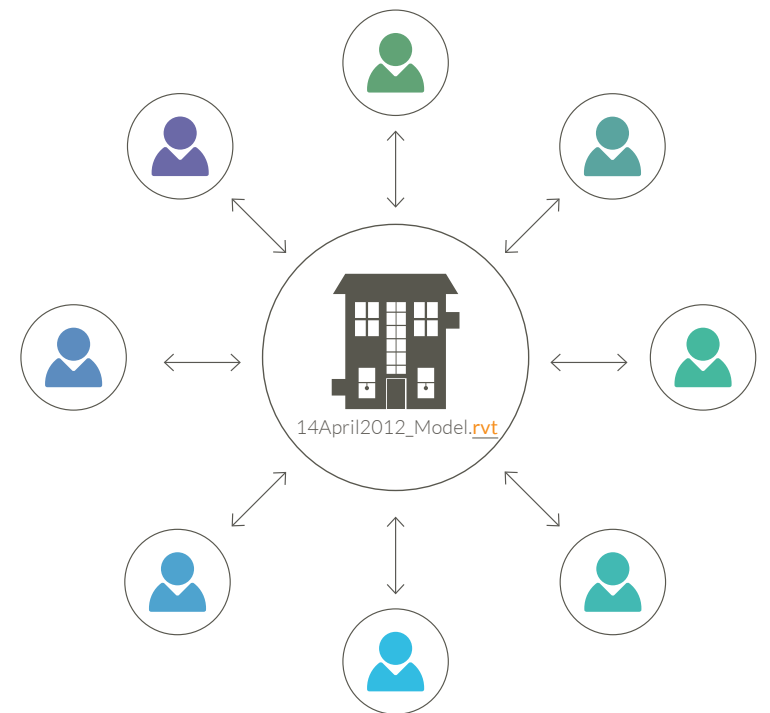
Building Information Modeling, commonly referred to as BIM, is a rapidly developing drafting and modeling tool within the Architectural, Engineering and Construction industries. On the surface, BIM software applications (such as Autodesk's Revit Architecture, or Graphisoft's Archicad) allow users to design and build central project models in both two and three-dimensional space. What makes BIM programs unique, however, is their ability to track and note all building components that go into a building model. For example, in Autodesk's Revit Architecture, a user can build a three-dimensional model precisely as it would be built

in the field. As the user adds structural elements like slabs, beams and columns, architectural elements like doors, windows and stairs, and engineering elements like ducts, pipes and electrical systems, Revit tracks all elements in a centralized project database. When elements are added, removed or otherwise altered, Revit dynamically updates the project file to reflect the changes in all views of the document (2D, 3D, & Text). When it comes time to produce specifications and construction drawings, the user can simply use Revit's detail and perspective views to produce schedules and drawings of everything within the model.

BIM is a powerful tool that is rapidly gaining in popularity among all building professions. However, architectural conservation and other industries focusing on the already built-world don't always have a need for a comprehensive building model - particularly when the building itself already exists. But this does not mean BIM cannot play a significant role in architectural projects involving existing structures or heritage objects. Conceptually, Building Information Modeling is nothing more than a carefully designed approach to project management. Specifically, project component management.

Example

A typical BIM project includes a centralized project model; a house for example (illustrated at the center of the diagram to the right). The house includes architectural elements such as doors, windows and stairs, structural-engineering elements such as columns, beams and sill-plates, and



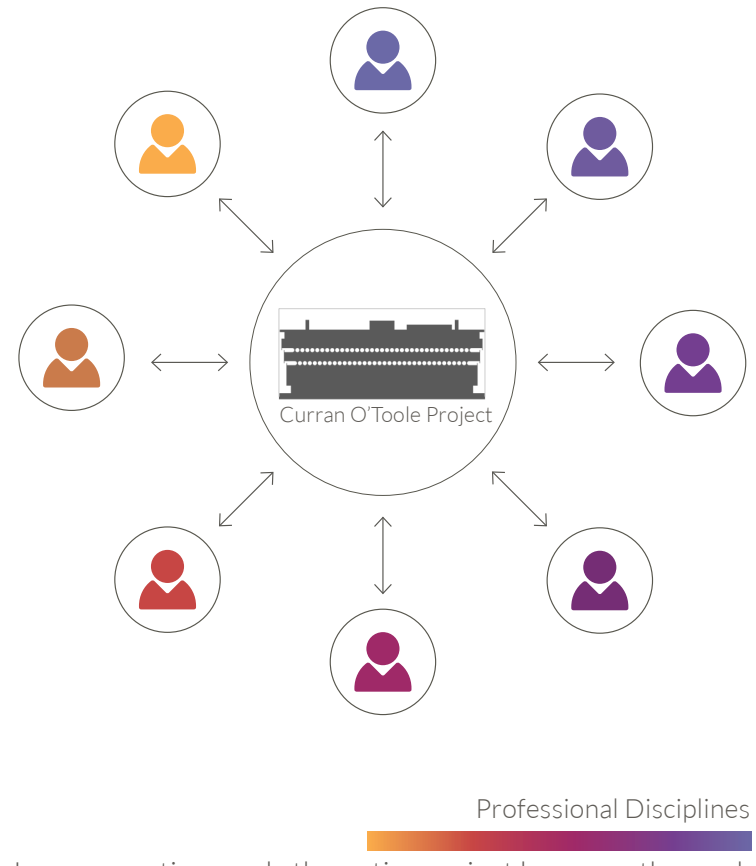
Professional Disciplines

Typical BIM coordination projects involve interdisciplinary professionals working around a central project model.

design elements such as floor finishes and window trim. The BIM program being used to design and manage the model takes note of all these house components in the form of a project database (a SQL database in most cases). Each element gets a table, and each sub-element gets a row and a column to note specific attributes regarding the corresponding element. When the architect or draftsman adds to or manipulates the house model, the database is automatically updated to reflect the changes (i.e., the numerical, text-based back-end is synced with the visual, two- and three-dimensional front-end). Now, let's take a step back from the house BIM example and widen our perspective to include the basic operations occurring behind the scenes.

In the typical BIM example illustrated above, we have three fundamental components: 1) the house, 2) the element (door, window, stair, etc) and 3) the database. Now, let's replace those fundamental components with the following: project-type for house, project-document for element, and centralized-document-storage for database. In any given office, architectural professionals may work on any number of projects at a time; each of those projects has its own set of documents, and all of those documents are typically stored in centralized project files, or databases (right illustration). The interactive relationships between these components holds the key to understanding the dynamic computational back-end required by an international project management and document collection system.

Note: It is important to break free from any pre-conceived associations between BIM and any corresponding commercial product; we are no longer talking about Revit or Archicad. We must first understand BIM as a



In conservation work, the entire project becomes the model; the records, documents, and information are all managed by a central project database which can be accessed by all professionals involved.

concept, before we can apply it as a tool. In fact, we should think of a BIM alternative: PIM – Project Information Management.

Conceptually, the Project Information Management approach is nearly identical to its BIM counterpart, however it goes beyond the confinements of a single three-dimensional model. The entire project becomes the model. The entire project, and all of its records and documents, are managed by a central project database. Just as new-construction industries often work from a central BIM project file, heritage professionals can do the same. The only difference is that in such cases involving architectural heritage, the content within the project database evolves from multidisciplinary contributions of project records and documents.

In the following chapters of this thesis, I will prove through a prototype design entitled The Heritage Project web- and desk-top application, that the contemporary cloud-based solutions to the considerations stated in chapter two, bolstered by the PIM approach described above, will restore the collective idea set forth by Robin Letellier, Kate Clark and the Council of Europe. We will see that what began as an idea over three decades past can today be realized on a previously unforeseeable scale. By fusing international standards, flexible frameworks, and the borderless possibilities within the information age, we, as architectural professionals may realize this for ourselves and ensure that the records and references we produce today are not only preserved for future generations, but provide new insight into the historical, geographical and cultural contexts defining our architectural heritage as well.

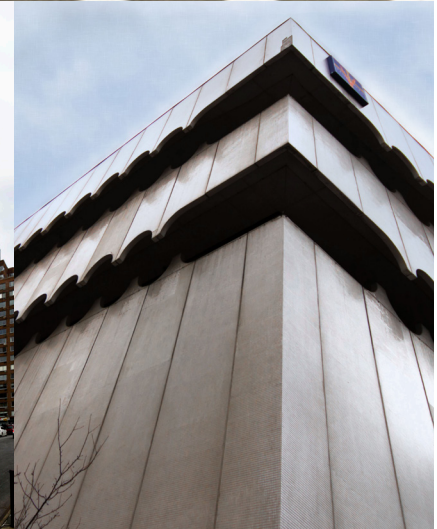
To introduce the cloud-based approach to data collection and project management, a fictional narrative of a typical adaptive reuse project in New York City will be presented through the eyes of a young, emerging architectural conservation professional via the interface of a contemporary tablet computer. All building documents and site images presented hereafter come from the author's personal work carried out during Columbia University's Historic Preservation Design Studio, spring 2011. All graphics, diagrams, illustrations and other material pertaining to the program design herein are created and copyright protected by the author, Patrick J. Caughey, and may not be reproduced, re-published or otherwise copied and used for any use without the author's explicit consent.

Five | Setting the Scene: Application Tour

1) Sample Project

Quinn Coy is a young conservation architect recently hired by Architectural Heritage – an experienced architectural conservation and design firm in New York City. Just last week, Architectural Heritage received the commission to redesign Albert Ledner’s Curran O’Toole building* – the 1960s, white scalloped-façade ensemble on the outskirts of the Greenwich Village Historic District. The Principals at Architectural Heritage have decided to appoint Quinn as the Junior Project Manager to lead the initial phases of the project.

As Junior Project Manager, Quinn will oversee the project initiation, assessment, options, and project development phases of the project. Quinn is delighted - not only because of the exciting responsibility just bestowed, but because the firm now has an opportunity to try out a new, freely-available open-source cloud-collaboration and file-synchronization application specifically developed for projects like the Curran O’Toole adaptive reuse in New York City. Quinn Coy has suggested to the Principals at Architectural Heritage that *The Heritage Project* web-



Top: Curran O’Toole 7th Ave & 12th St NW Corner Perspective

Middle-left: Curran O’Toole Annex, 12th St NE Perspective

Middle-right: Curran O’Toole 7th Ave 14th St SW Corner Perspective

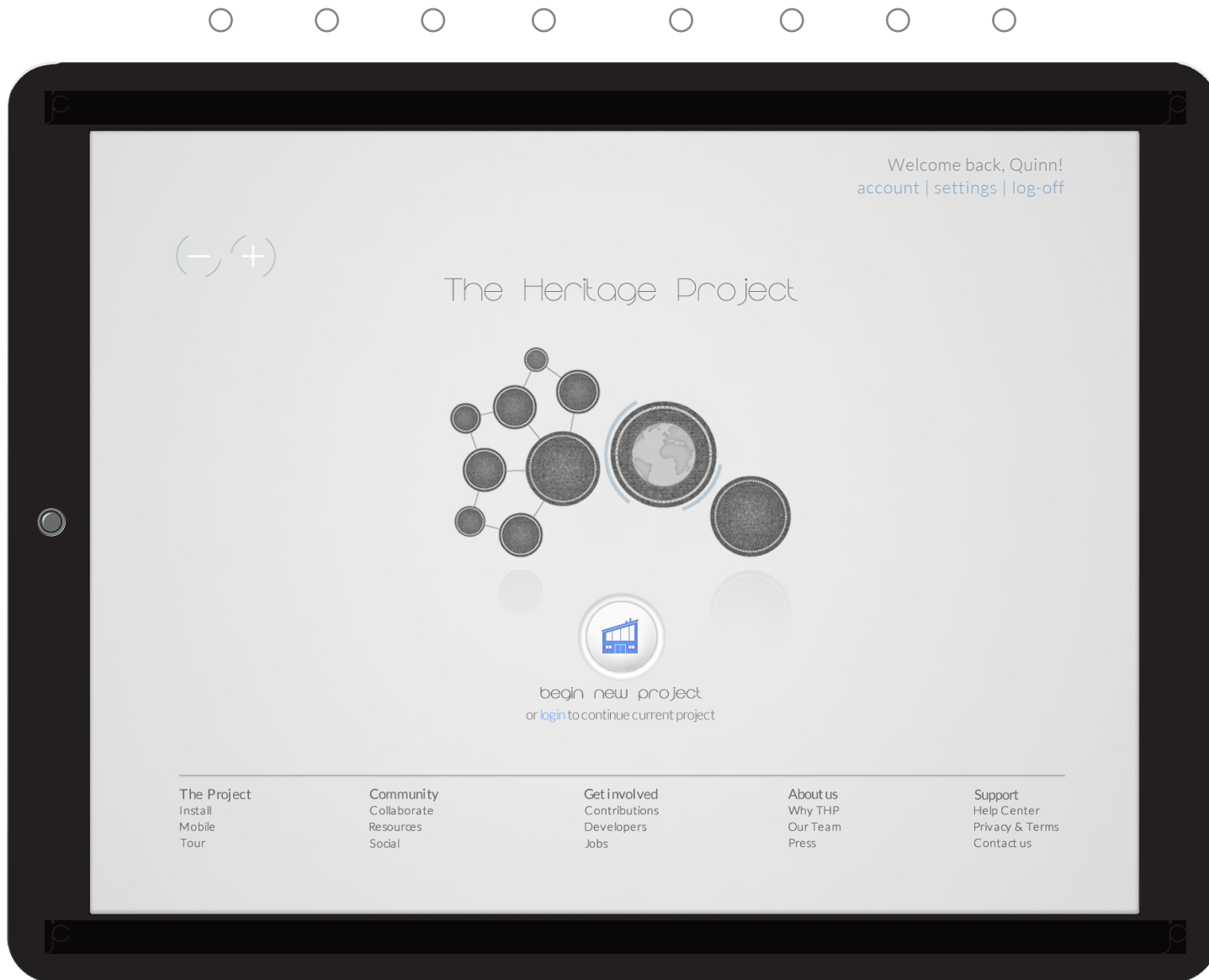
Image source: Patrick J. Caughey

and desktop-application might be something worth looking into.

The Principals of Architectural Heritage have requested a brief demonstration of the software application. Quinn agrees, and states that “once all past records and documents to the Curran O’Toole building are collected and scanned, I would be happy to demonstrate the Project Initiation phase of *The Heritage Project* application.” Quinn Coy and the rest of the project team gather all the historical records and references to the Curran O’Toole building they can find, scan, upload and/or organize all digital records, and reconvene with the Principals of Architectural Heritage the following week.

At 8:00am Monday morning, on the 13th floor of a nineteenth-century cast-iron façade building - just a few blocks south of New York City’s High Line Park - Quinn Coy and the rest of the Curran O’Toole project team arrange their documents and prepare their presentation in the conference room of Architectural Heritage.

By 8:05am, the Principals arrive. Quinn removes the firm’s sleek new tablet computer from beneath the scattered stack of city documents and building records... swipes, slides and motions through the tablet’s interface and arrives at *The Heritage Project* application homepage.



Step One: Select “Begin New Project” and proceed to the Project Reference Dialogue on the following page.



The screenshot shows a tablet displaying a 'Project Identification' dialog box. At the top, there are seven circular indicators, with the first one on the left being blue and the others grey. The dialog box has a title bar with a logo and three tabs: 'Project Identification' (active), 'Project Information', and 'Project Notes'. Below the tabs, a paragraph of text reads: 'Great! Now that you've decided to begin a new project, the first step is to create and populate the project database. Please fill out the basic information below, and proceed to the following steps of the project initiation phase.' The form is divided into two columns. The left column is titled 'Project Name & Type' and contains a text input field with 'Curran O'Toole' and a question mark icon, labeled 'Project Name *', and a dropdown menu with 'Building' selected and a question mark icon, labeled 'Project Type *'. A tooltip bubble points to the dropdown menu with the text: 'Select Building, Monument, Site or "Other" if choice not listed.' The right column is titled 'Recording Organization' and contains three input fields: a text field with 'Architectural Heritage' and a question mark icon, labeled 'Name of Organization *'; a text field with 'AH_NY10125' and a question mark icon, labeled 'Internal Project ID *'; and a text field with 'pjc2143@columbia.edu' and a question mark icon, labeled 'Administrative Contact *'. At the bottom of the dialog box are three circular buttons: a close button (X), a cancel button (square), and a next button (arrow).

Project Identification Project Information Project Notes

Great! Now that you've decided to begin a new project, the first step is to create and populate the project database. Please fill out the basic information below, and proceed to the following steps of the project initiation phase.

Project Name & Type

Curran O'Toole ?
Project Name *

Building ▼ ?
Project Type *

Select Building, Monument, Site or "Other" if choice not listed.

Recording Organization

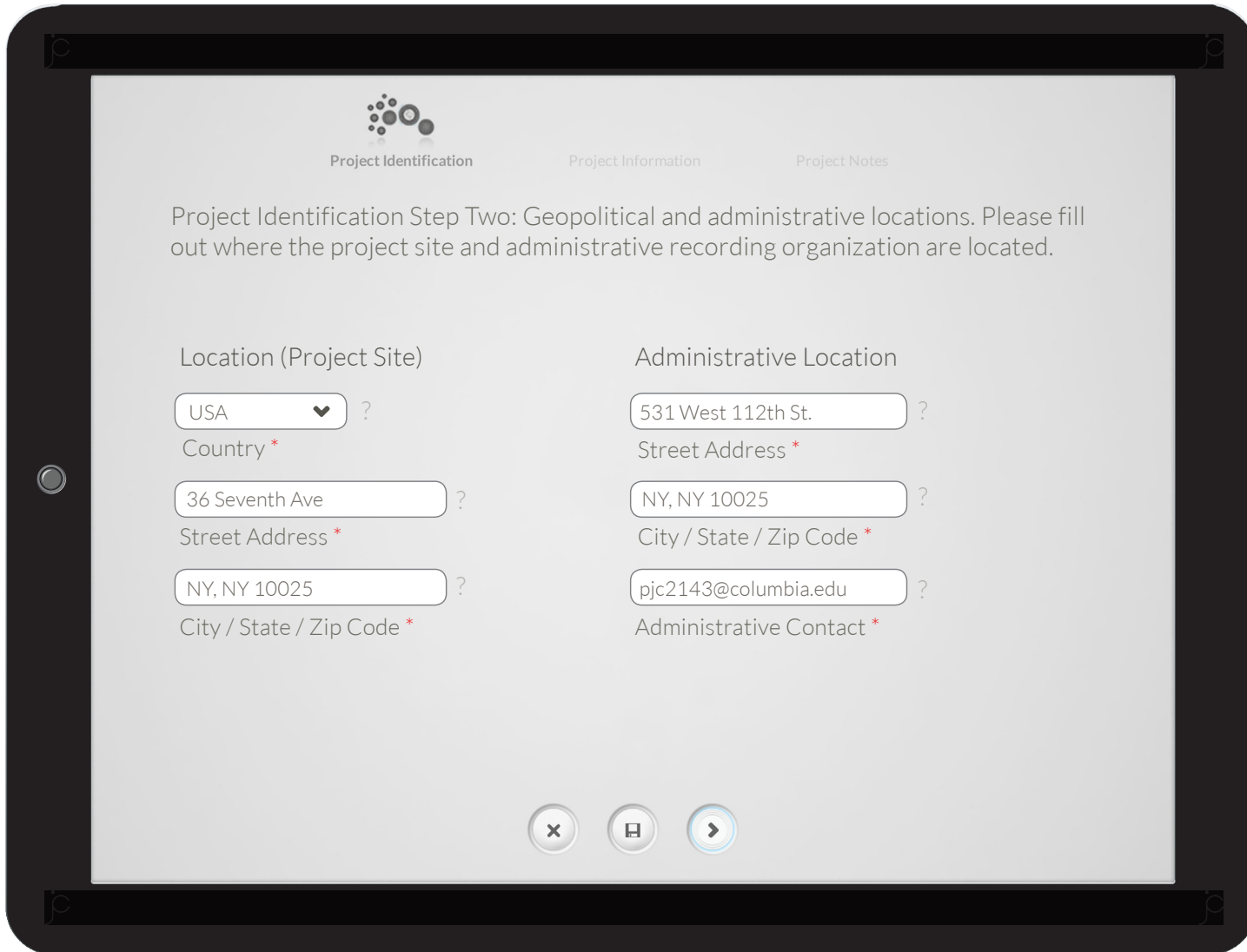
Architectural Heritage ?
Name of Organization *

AH_NY10125 ?
Internal Project ID *

pjc2143@columbia.edu ?
Administrative Contact *

✕ □ ➤

Project Identification: The Project Reference Dialogue process begins with Project Identification.



Project Identification Step Two: Geopolitical and administrative locations. Please fill out where the project site and administrative recording organization are located.

Location (Project Site)	Administrative Location
<input type="text" value="USA"/> ? Country *	<input type="text" value="531 West 112th St."/> ? Street Address *
<input type="text" value="36 Seventh Ave"/> ? Street Address *	<input type="text" value="NY, NY 10025"/> ? City / State / Zip Code *
<input type="text" value="NY, NY 10025"/> ? City / State / Zip Code *	<input type="text" value="pjc2143@columbia.edu"/> ? Administrative Contact *

Navigation buttons: Close (X), Home (House icon), Next (Arrow icon)

Project Identification continues with project-site and administrative locations.

Project Identification Project Information Project Notes

Step Two: Project Information. Please provide any significant dates, individuals involved in the building's history, and a general description of the building itself.

Original Building Type & Category	Current Building Type & Category	Work Proposed
Private Use ? Category *	Medical ? Category *	Adaptive Reuse ? Category *
Union Headquarters ? Type *	Hospital ? Type *	Medical ? Category *
Dating This section allows for precise dating when it is known, or date ranges or periods when it is not, i.e. century, period or date range. 1963 to 1973 Duration of Original Use *	Dating 1973 to 2011 Duration of Current Use *	Level 1 Trauma ? Type *

Navigation: [Close] [Home] [Next]

Project Information: Here, information regarding the building's original, current and proposed use is collected from the project administrator.

The image shows a tablet displaying a web application interface for a heritage project. At the top, there are seven circular navigation icons, with the second one from the left highlighted in blue. The interface has a dark grey header bar with a logo in the center and three tabs: 'Project Identification', 'Project Information' (which is active), and 'Project Notes'. Below the header, the main content area is titled 'Step Two: Project Information Continued...'. It is divided into two columns. The left column is titled 'Persons & Organizations Associated with the History of the Building' and contains three input fields: 'Architect' with a dropdown arrow, 'Albert Ledner' with a question mark, and 'Client' with a dropdown arrow, followed by 'National Maritime Union' with a question mark. Below these is a blue button with a plus sign and the text 'Add additional contributing professionals.'. The right column is titled 'Building Materials & Techniques (Structural & Non-structural)' and contains two sections. The first is 'General Style' with a dropdown menu showing 'Modern' and a question mark. The second is 'Physical Description' with a question mark, followed by a text area containing the description: 'Exterior: pre-cast concrete panels, white. Steel and concrete frame, column grid @25' O.C. Ground Floor + Mezz. open plan, column grid supported by concrete girders and link-beams above mezz. structure.' At the bottom of the screen, there are three circular navigation buttons: a close button (X), a home button (house icon), and a next button (right arrow).

Project Information continues with the option to specify individuals and/or organizations that are relevant to the structure's history.

The screenshot displays a tablet interface for a heritage project. At the top, a row of seven circles indicates the progress, with the third circle from the left being filled blue. The interface has a dark grey border with a small 'p' icon in each corner. The main content area is light grey and features a logo at the top center consisting of a cluster of dots. Below the logo are three tabs: 'Project Identification', 'Project Information' (which is active), and 'Project Notes'. The title 'Step Two: Project Information Continued...' is centered. The form is divided into two columns. The left column is titled 'Protection / Legal Status' and contains the question 'Is the building locally protected, state protected, nationally protected? If yes, please explain below.' Below this are two radio buttons: 'Yes' (selected, indicated by a blue dot) and 'No'. A text box below the 'Yes' button contains the text: 'The Joseph Curran Building, designed by the New Orleans architect Albert Ledner as the headquarters of the National Maritime Union, has, since its completion in 1963, been an assertive and somewhat anomalous presence in Greenwich Village (and now the Greenwich Village Historic District.)' with a small double-checkmark icon at the bottom right. The right column is titled 'Relevant Dates to Protection / Legal Status' and contains a text box with '1969' inside a rounded rectangle. Below this is the label 'Year Building was Designated *'. Another text box below contains 'New York City Landmarks Preservation Commission; The Greenwich Village Historic District'. At the bottom of the right column is the label 'Designating Organization & Associated District *'. At the very bottom of the interface are three circular navigation buttons: a close button (X), a home button (house icon), and a next button (arrow icon).

Project Identification Project Information Project Notes

Step Two: Project Information Continued...

Protection / Legal Status

Is the building locally protected, state protected, nationally protected? If yes, please explain below.

☒ Yes ☐ No

The Joseph Curran Building, designed by the New Orleans architect Albert Ledner as the headquarters of the National Maritime Union, has, since its completion in 1963, been an assertive and somewhat anomalous presence in Greenwich Village (and now the Greenwich Village Historic District.)

Relevant Dates to Protection / Legal Status

1969

Year Building was Designated *

New York City Landmarks Preservation Commission; The Greenwich Village Historic District

Designating Organization & Associated District *

Project Information continues with optional fields for information regarding the structure's current designation or legal status.

The screenshot shows a tablet-like device displaying a web interface. At the top, there are seven circular navigation buttons. The interface has a header with three tabs: 'Project Identification', 'Project Information', and 'Project Notes' (which is active). Below the tabs, a text prompt reads: 'Step Three: Project Notes. Please include any additional information you would like to include in the project identification sheet using the form below.' This is followed by a 'Historical Summary' section with a rich text editor toolbar (bold, italic, underline, link, image, video, eraser, settings). The text area contains three paragraphs about the Joseph Curran Building. Below the text area is a file upload section with the text 'Upload additional documents (accepted formats: .doc, .docx, .pdf)', a text input field containing 'Curran-O'Toole.docx', and an 'Upload' button. At the bottom of the interface are three circular buttons: a close button (X), a home button (house icon), and a next button (arrow icon).

Project Identification Project Information **Project Notes**

Step Three: Project Notes. Please include any additional information you would like to include in the project identification sheet using the form below.

Historical Summary

B / *I* / U [Link] [Image] [Video] [Eraser] [Settings]

The Joseph Curran Building, designed by the New Orleans architect Albert Ledner as the headquarters of the National Maritime Union, has, since its completion in 1963, been an assertive and somewhat anomalous presence in Greenwich Village (and now the Greenwich Village Historic District.)

Its distinctive modern design *stands in sharp contrast* to the mostly 19th and early 20th Century architectural context while Ledner's highly expressive idiom separates his work from the mainstream modernism of the time. The Curran-O'Toole Building also stands as a reminder of the West Village's long history of maritime activity and associations.

For various reasons the stature and real estate needs of the NMU declined in the 1960s and 70s, and the Curran building was **sold by the Union in 1973 to St. Vincent's Hospital**, which converted it into medical offices and re-named it the Edward & Theresa O'Toole Building.

Upload additional documents
(accepted formats: .doc, .docx, .pdf) Upload

[Close] [Home] [Next]

Project Notes: The Project Reference dialog concludes with an open text body and file-upload field so the project administrator may include any additional notes or documents he/she feels necessary to include with the Project Reference sheet.

Project Identification

Project Information

Project Notes

Great! Your new project database has successfully been created. Now, please tell us who you would like to add as additional project administrators to the Curran O'Toole Adaptive Reuse heritage project. Remember, once active these additional project administrators will be allowed to invite additional contributors to this project. Additional administrators can also be added later through the Project Settings page.

Project Administrators

Material Scientist ?

Professional Discipline *

norman_@gneiss.com ?

email *

Hi Norm,
Quinn Coy has invited you
to join the Curran O'Toole
project. Click [Here](#) to join!

Optional message

Structural Engineer ?

Professional Discipline *

jonas_@steelbeams.com ?

email *

Optional message

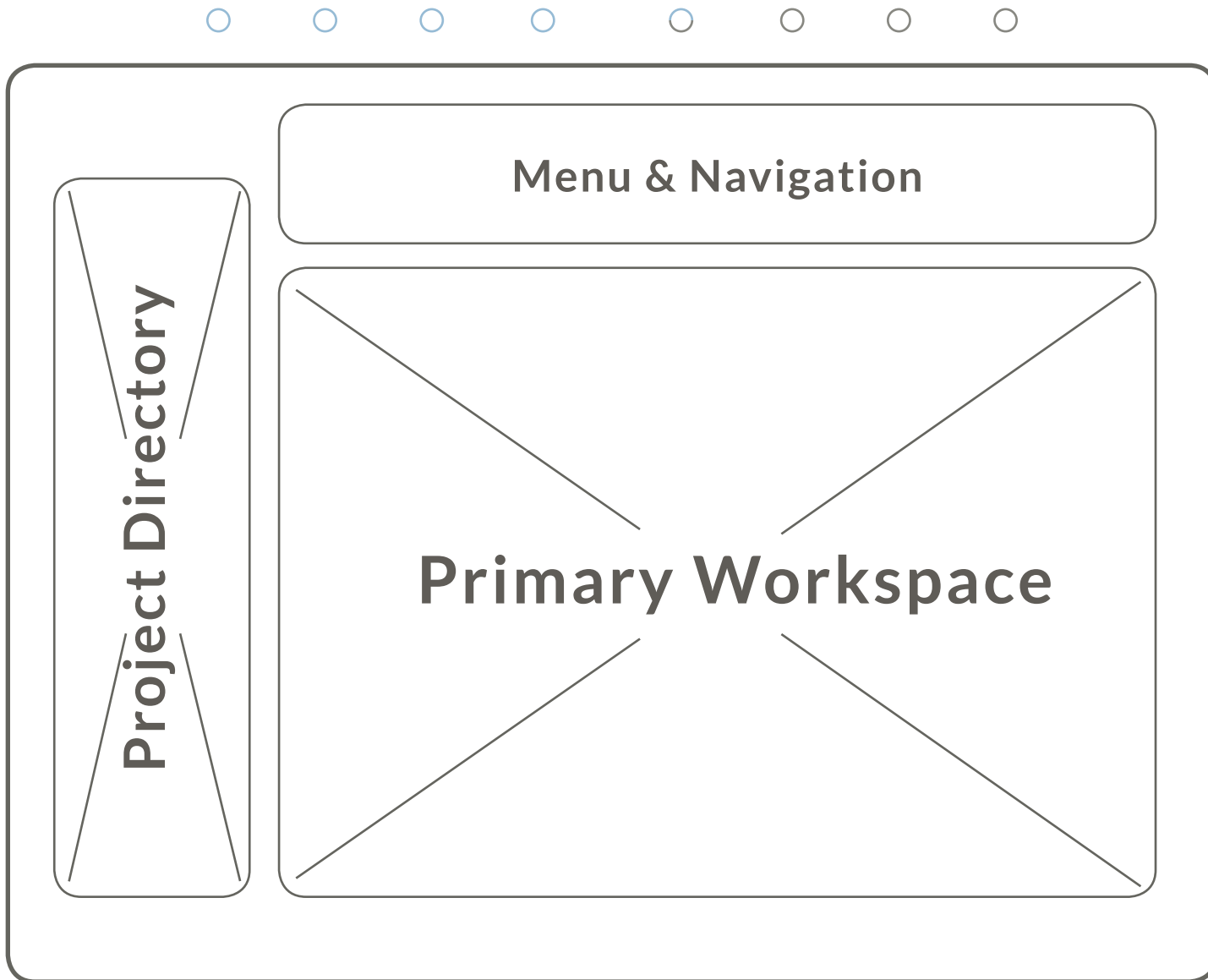
Urban Planner ?

Professional Discipline *

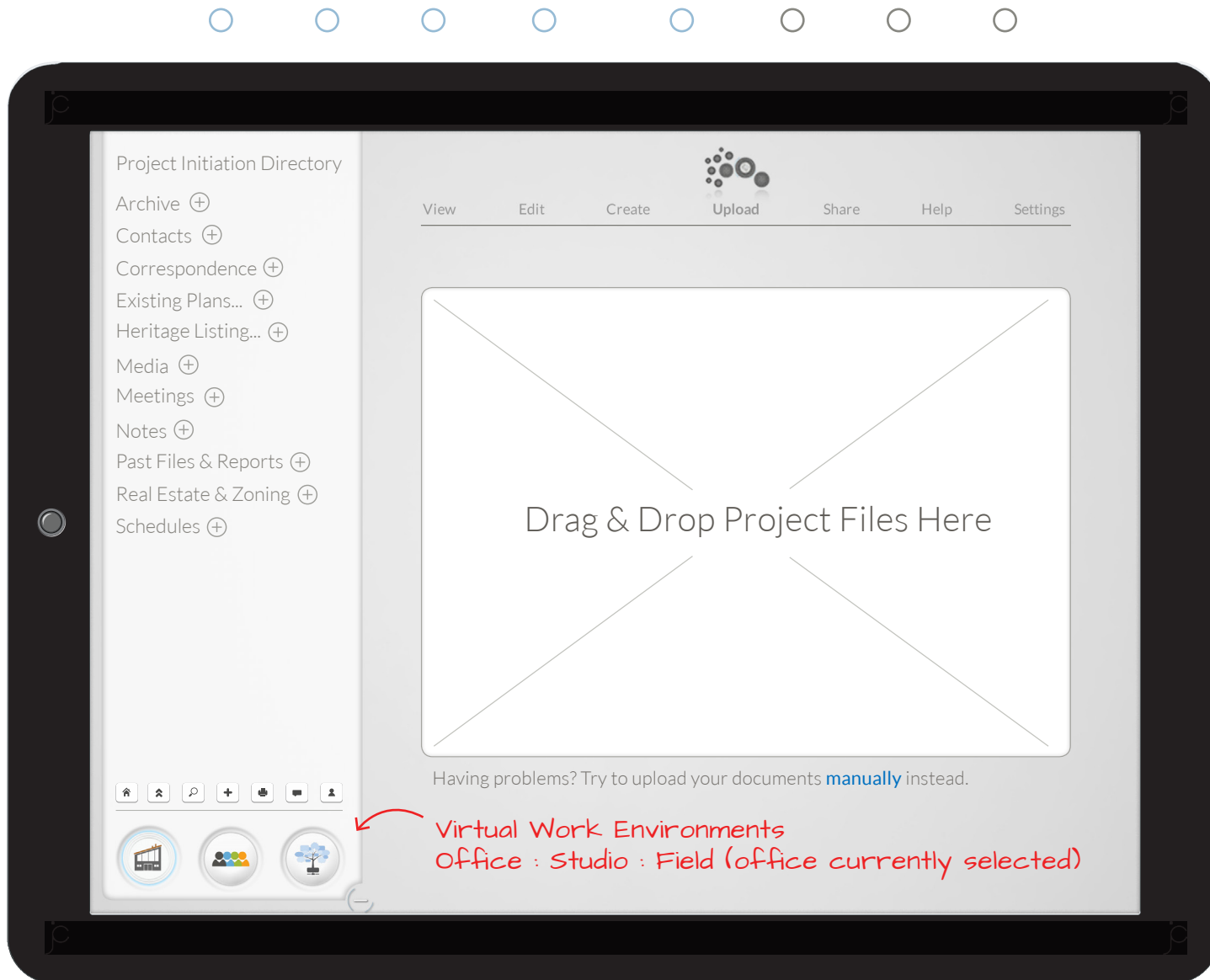
+

Add additional
contributing
professionals

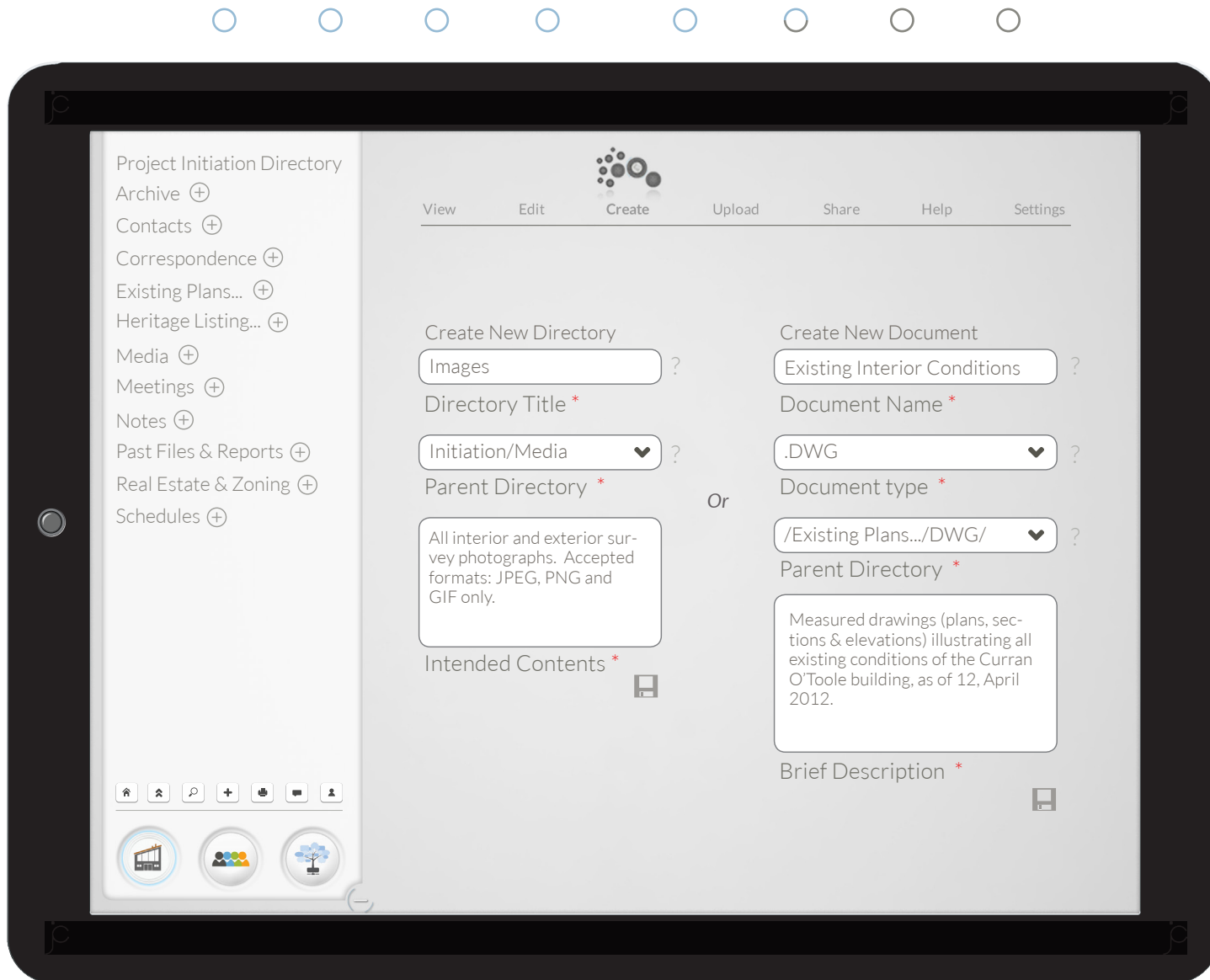
Following the previous page, the project administrator is given a chance to invite additional project managers and project contributors to join his/her newly established project. Invitations are sent via secure messaging services and include a direct link for recipients to confirm and proceed to the project workspace.



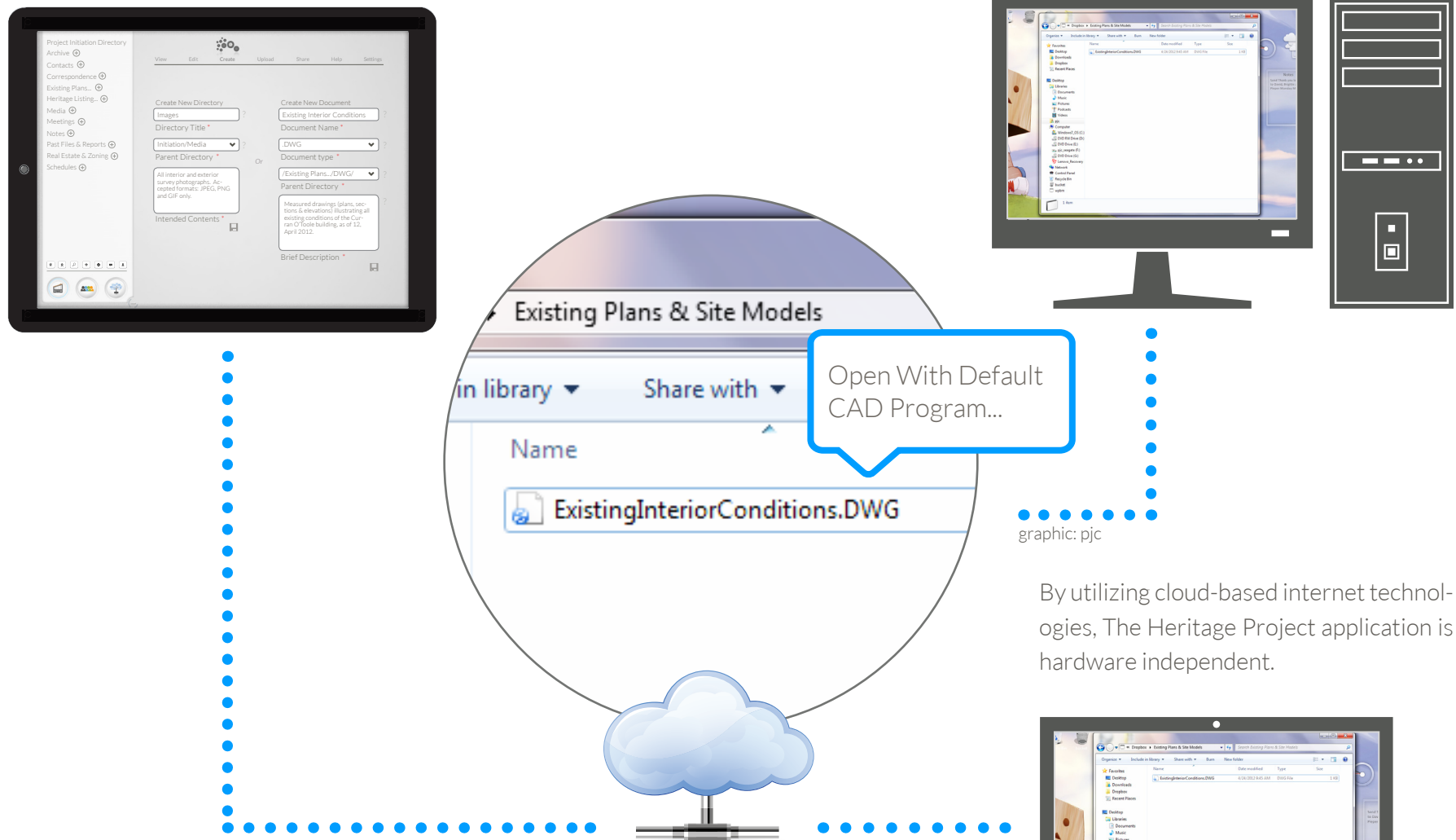
The Heritage Project application interface is organized into three primary work spaces: Project Directory, Menu & Navigation, and the Primary Work Space. All files and documents are accessed through the project directory; edited, shared and viewed through the primary workspace, and managed through the various options found within the menu & navigation area.



Project administrators and contributors are assigned to unique virtual work environments, called “Offices” (marked by the icon on the bottom left of the application interface). When professionals first join they can upload project records, view existing records or explore the other virtual work environments assigned to other project team members.



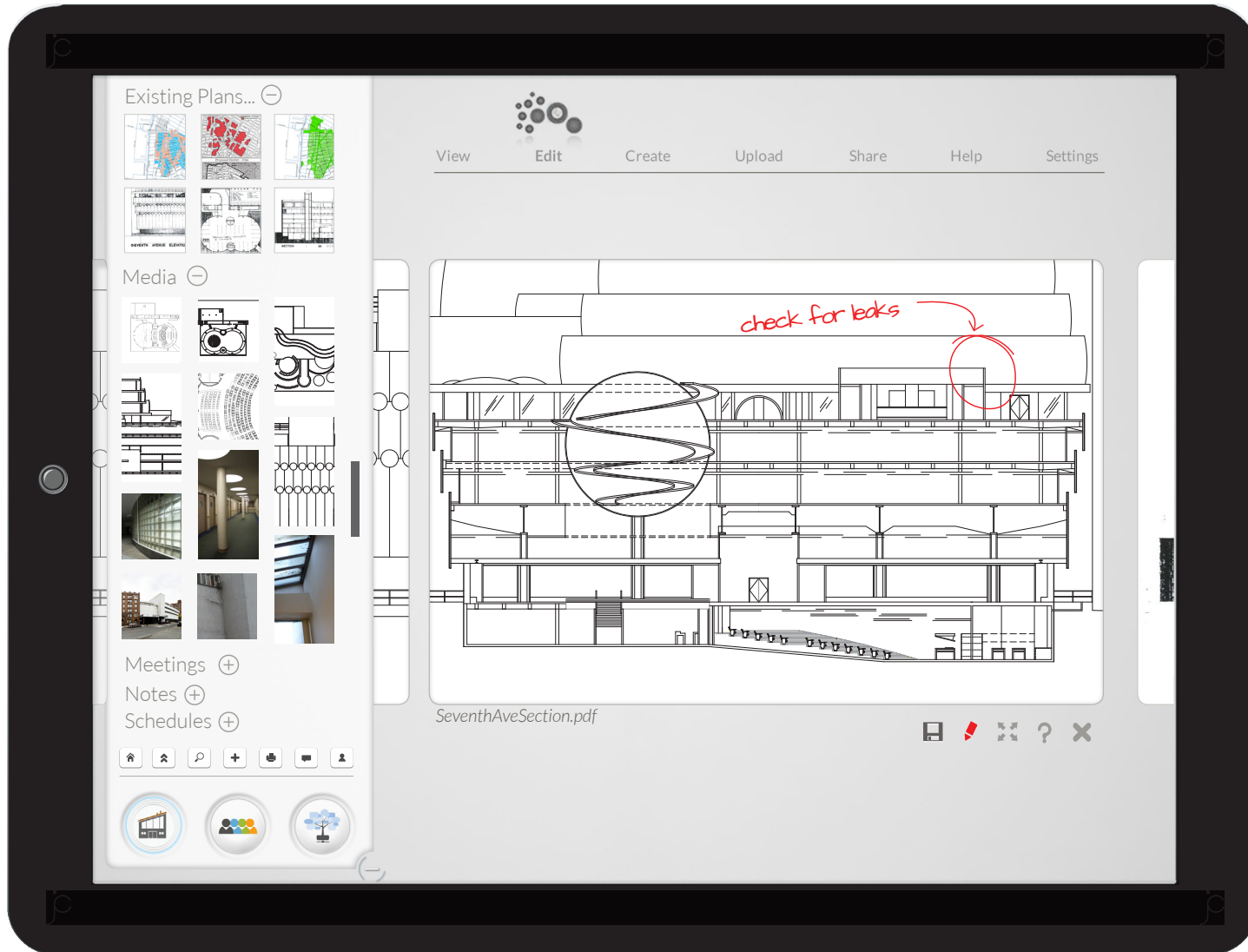
Project administrators and contributors have the option to create new project directories and/or documents from within the application. The benefit of going through this process via the application is consistency in directory and document nomenclature, as well as descriptive meta-information which will assist in querying information later on. *Diagram continues on following page...*



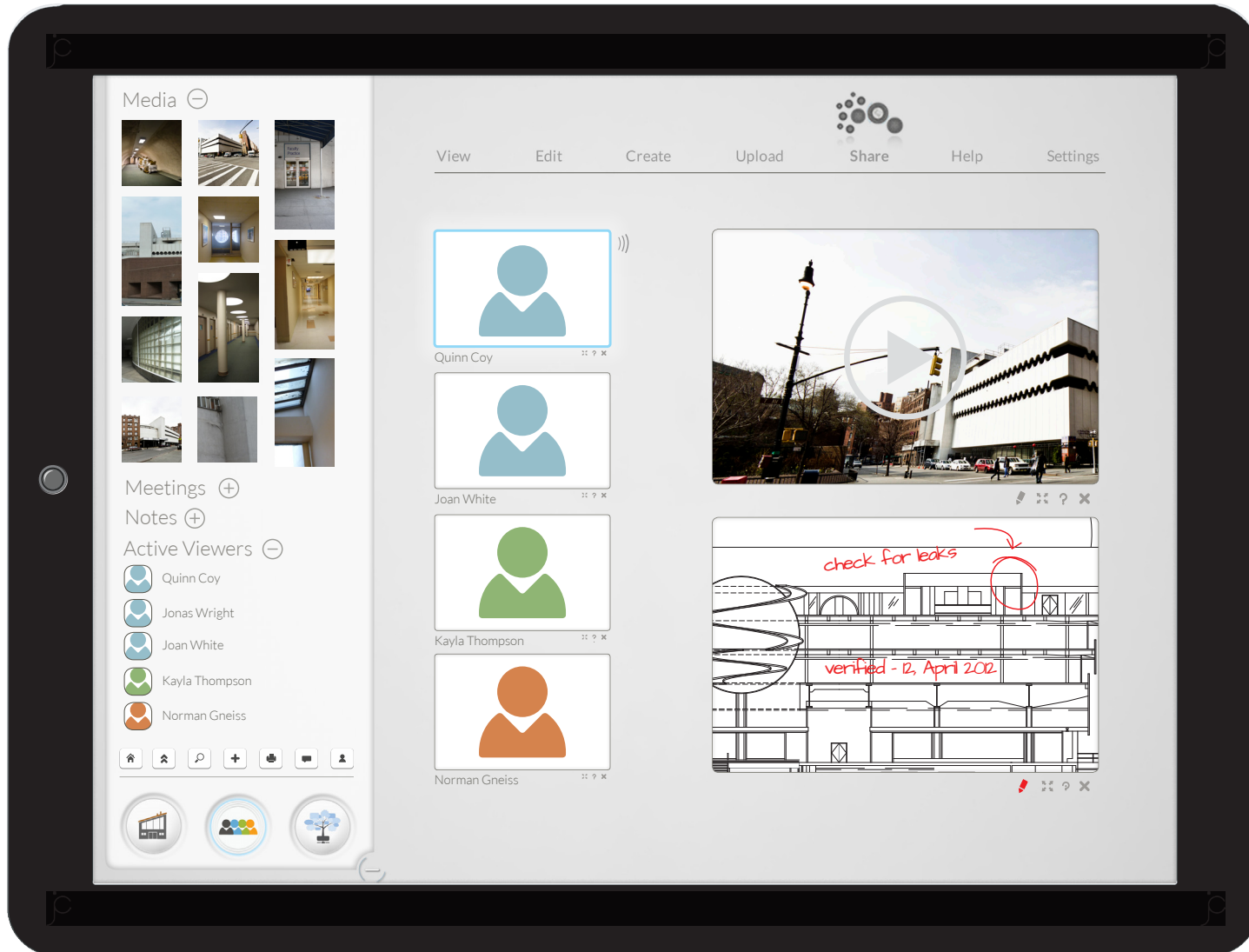
When new directories and/or documents are created within *The Heritage Project* application, all connected devices are dynamically updated to reflect the most recent changes to the project file system. This way, documents can be created via The Heritage Project interface and be able to operate within their native programs (Autodesk's AutoCad, for example).



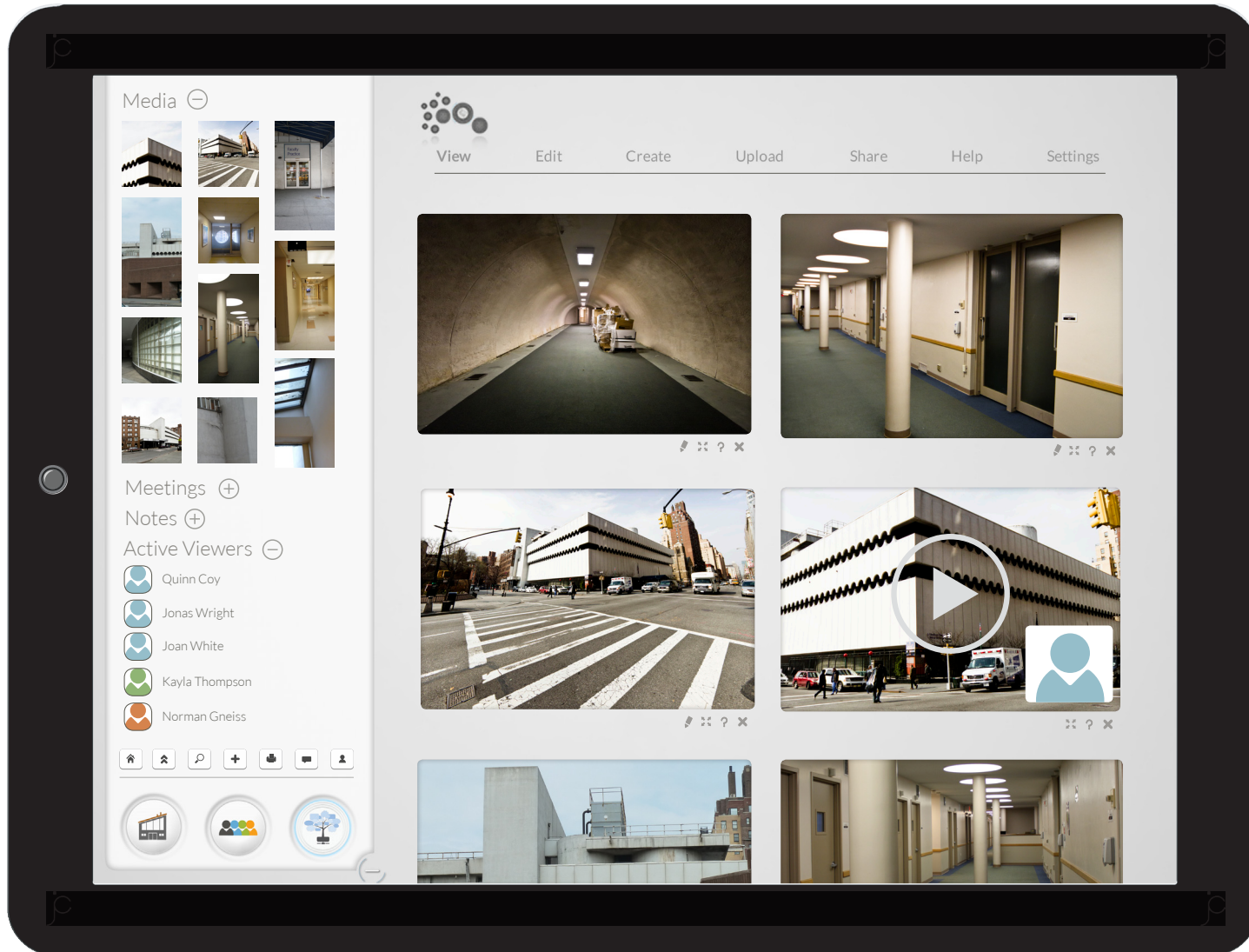
Folders and documents viewed from within The Office are private to those professionals assigned to that respective work group. Outside project contributors cannot view or edit documents outside of their assigned spaces. If set to “Public,” documents can, however, be viewed and edited from within the “Studio” (Public) work environment.



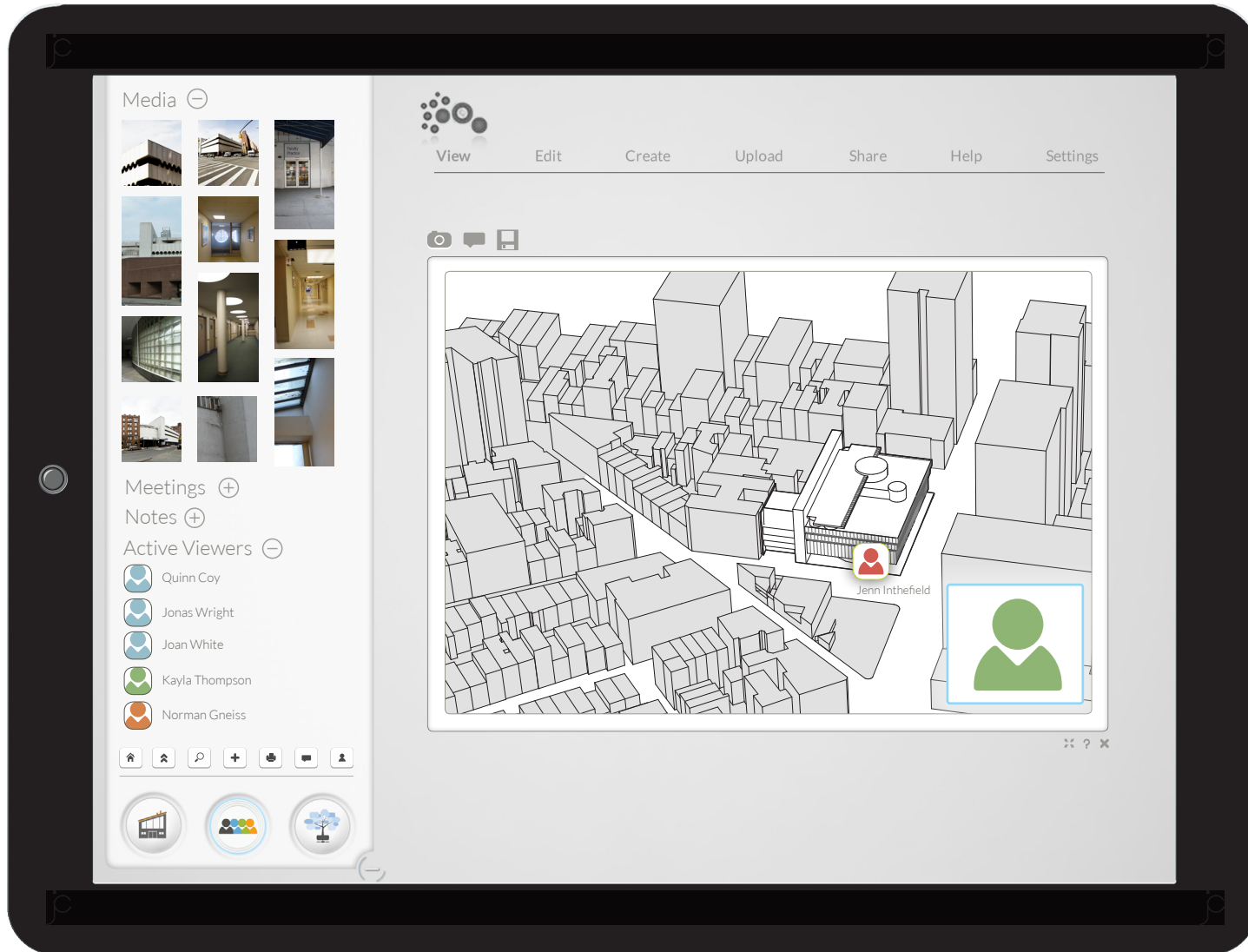
When files or documents are viewed through the Edit workspace, professionals have the option to annotate or sketch their notes onto a top transparent layer of the opened document. All annotated documents are saved and placed within their own respective annotated file directory (the original documents are not changed or affected during annotation).



Project contributors from all disciplines interact in The Studio work environment. Professionals can participate in video conference calls and simultaneously view & edit public project documents. Presence Indicators within the Project Directory workspace allow users to see who else is currently online and available to collaborate with on project documents.



Professionals logged in from within The Field can access all project documents locally stored on their mobile device or on the project's cloud server (depending on internet access). In the field, professionals can communicate with other contributing members back in the office; they can send images, video, or audio to the public media folders. They can annotate drawings and receive further instructions from active viewers as well.

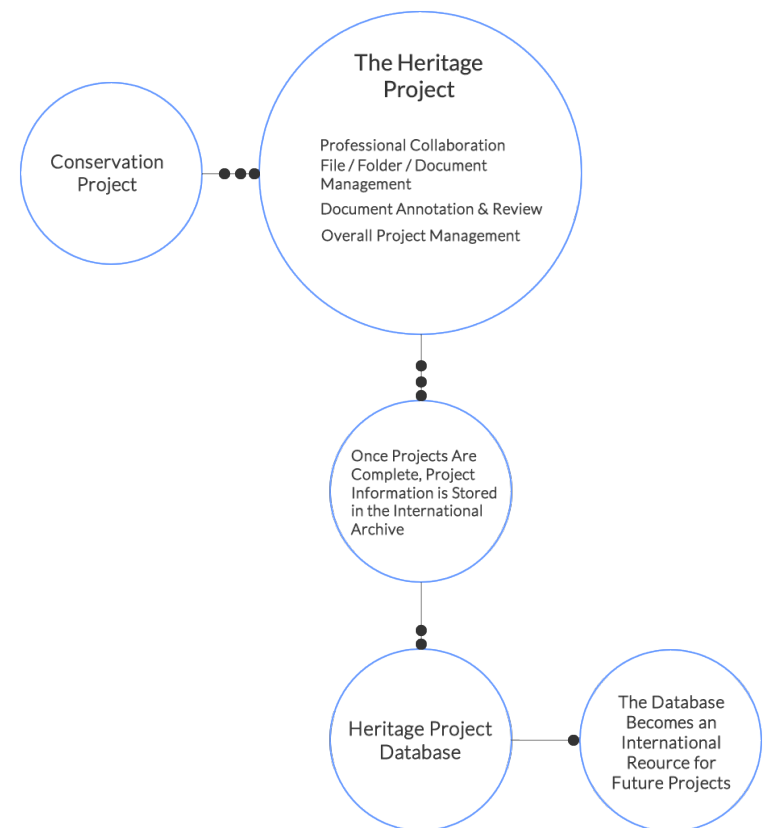


Professionals in The Office or Studio can view live video feeds of the professional in The Field as they inspect the project site, or they can receive updates and images regarding inspection progress in real time. Building documents can be overlaid GPS & Location maps, allowing professionals in the office to monitor and guide site inspections if and when it becomes necessary.

2) What it is & How it Works

The intention of *The Heritage Project* web- and desktop-application is twofold. Its first intent is to provide cost-effective and flexible online hosting service for local, national and international architectural conservation projects that encourages and facilitates interdisciplinary collaboration by incorporating international standards and best-practice guidelines for recording, documentation and information management. Its second intent is to capture bits of information as it flows through the collaboration and file management software for the sole purposes of establishing an inventory of international project information.

The theory is that by establishing reciprocal relationships between users of the application and the application itself, the second primary challenge causing architectural organizations' tendency to not invest in contemporary data sharing systems (its financial costs and uncertain returns) will be off-set. The value exchange is changed from a perceived negative financial return associated with technological investment to a mutual exchange: increased project efficiency, access to project collaboration utilities and cloud storage in exchange for bits and bytes of architectural project information.



Flow of information through *The Heritage Project* application.

A Note on Financial Requirements

The application presented in the previous chapter is based entirely on readily available open-source software. The term open-source refers to a particular type of legal protection that not only grants end-users access to a program's source-code, but also the freedom to use and re-develop the program as they wish. The catch under such titles is that any program that is developed from open-source software must remain open-source and must comply with the parent program's limitations stated under its open-source license. A common catch-phrase associated with open-source software is that it should be considered "free" as in "free-speech," not free as in "free beer."

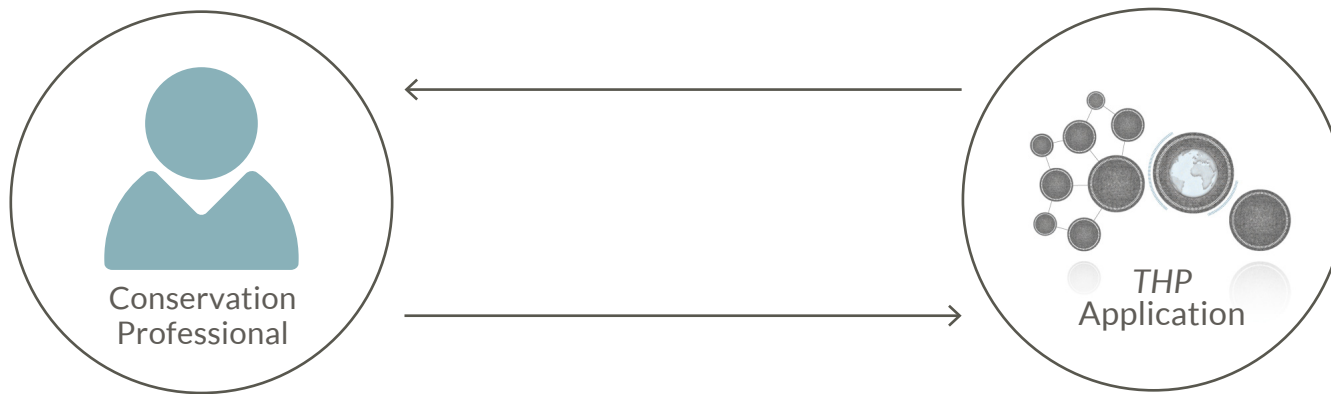
Because of its foundation, *The Heritage Project* web- and desktop-application is considered an open-source program, and as such, must conform to the accessibility and use limitations of its parent platforms (a list of platforms is included within the appendix of this thesis). Two salient questions arise from this development method: how will its development be financed, and who is responsible for its on-going operations and maintenance?

The answer to the second question is easy. We, architectural professionals, are responsible for its on-going operation and maintenance. The only financial costs associated with on-going operation and maintenance are domain fees, server fees and time. Such burdens are easily distributed among groups of interested firms or offices (the savings in reduced overhead costs associated with poor project management alone offset the

nominal domain-space and server fees). Alternatively, depending on the volume of traffic, AEC-targeted advertisers could purchase ad-space on the website, receiving direct access to potential customers and simultaneously covering the financial requirements of the program's on-going operation, maintenance and future development. That's the answer to the second question. The answer to the first question is only slightly more complicated.

Developing the application requires a certain level of professional knowledge and skill with respect to computer- and web-based development. Now, hypothetically, the application could be developed with no financial costs at all. The tools and resources necessary for the job are freely available online; a brave architectural professional (or even a group of architectural professionals) could feasibly acquire the knowledge and skills necessary to build it themselves. Realistically, however, the initial development efforts would have to be financed by an organization, such as the American Institute of Architects (the AIA), or the World Monuments Fund.

What it is & How it Works: *The Heritage Project* Diagrams



Reciprocal relationships between working professionals and *The Heritage Project* application provide the necessary incentive for professionals to share information and receive something worth their while in return.

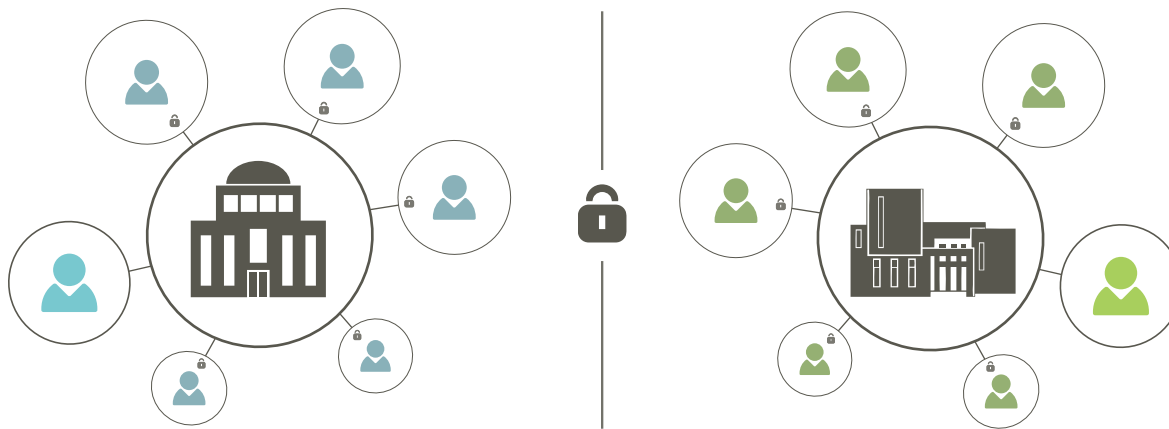
It is important to note that all project records and documents are kept confidential throughout the entire active process of a given project. Only when the project is complete and all administrators have signed off on the project itself do the documents become available for archive.

Professional's Incentive



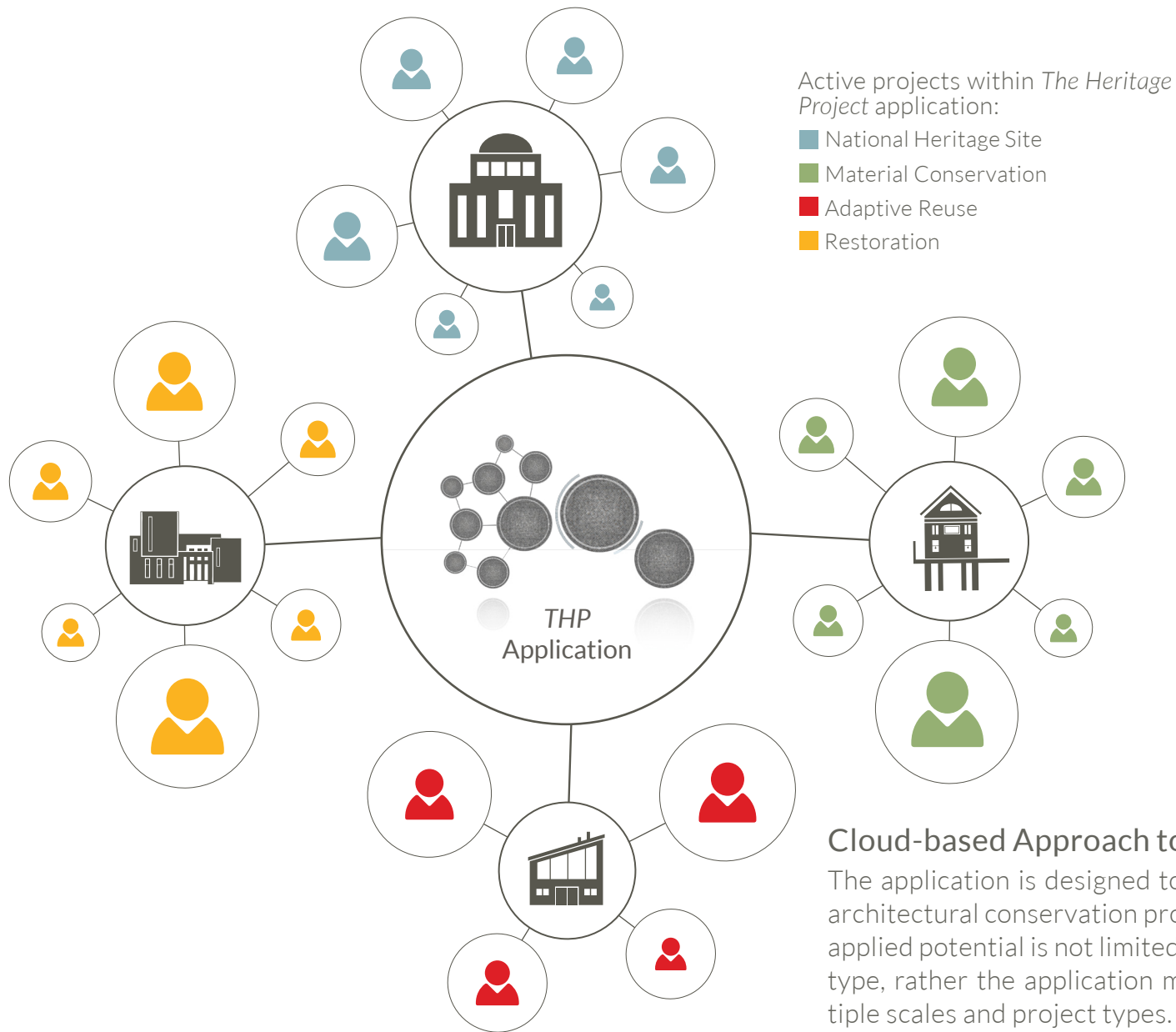
- Increased Project Efficiency
- Cloud File and Document Hosting
- Accurate Records of all Project Documents & Decisions
- Widely Accessible Platform for Project Collaboration
- Office to Field Communication Utilities
- Project Information Backup and Management
- Security and Privacy of all Documents
- Comprehensive Project Reports Throughout Project Process

Professional's incentives are derived from the project management, collaboration, communication, file management and template engine software utilities embedded within the computational back-end framework of *The Heritage Project* application.



How are files kept private?

When a project is first initiated, it is assigned its own unique project-database. In addition to handling all incoming and outgoing data regarding the project “object” (be it a small residential building or a national heritage site), the unique project-database contains tables for project contributors, project administrators, individual accessibility and user-permissions. Project databases can only be accessed by users involved with that specific project. Users can only access files and documents that their assigned roles and permissions *permit* them to. All layers of the system are based on a standard parent-child relationship; security and accessibility protocols are assigned accordingly.



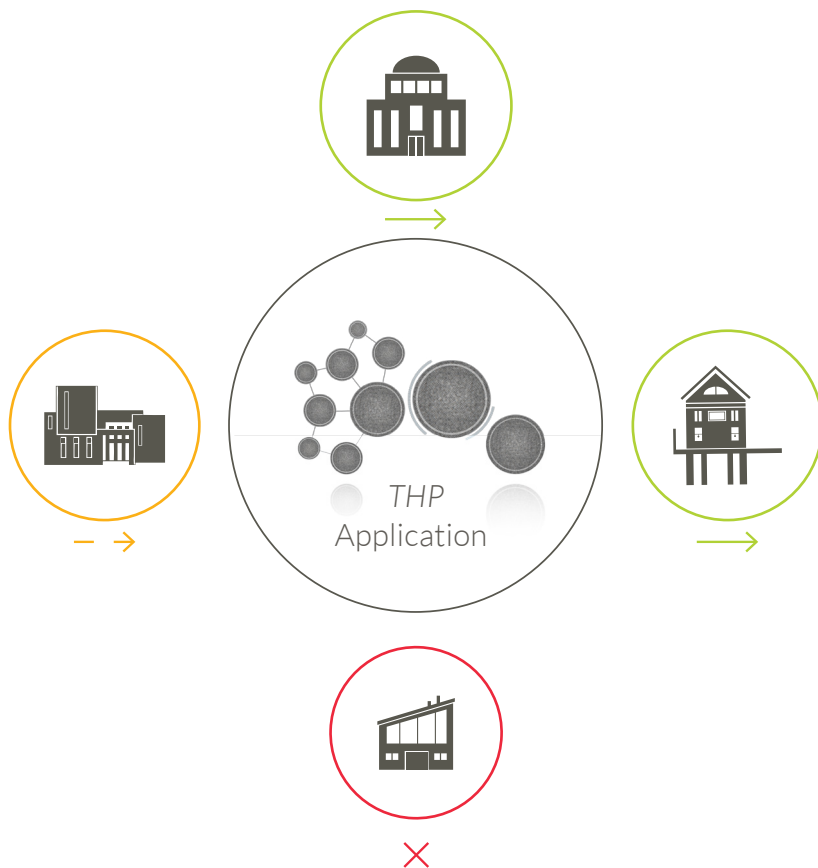
Cloud-based Approach to Project Management

The application is designed to handle a diverse array of architectural conservation projects at any given time. Its applied potential is not limited to a single scale or project type, rather the application may be applied across multiple scales and project types.

Note: Project references continue on following page...

Cloud-based Approach to Project Data Collection

Once projects are completed, participating professionals may choose to include all project data to the international archive, partial data to the archive, or to retrieve and delete all project documents and information from their unique project database.



For example, **Two** out of four recently completed projects have been submitted to *The Heritage Project* archive in their entirety. Project administrators of the **third** project have decided to submit only partial building documents and historical research. The **fourth** completed project has been retrieved by its administrators and will be removed from the online database immediately; less its project reference sheet.

Project Administrator and Contributor Structure

When a heritage professional decides to begin a new project, he or she becomes the top-level project administrator*. They have complete, unrestricted access to all elements of the project. When the project administrator decides to send invitations to other contributing professionals, and when those professionals choose to join the project, they enter the project on the second-tier of project contributors** – their permissions are set by the top-tier administrator and are one degree more restrictive. What's important to note about this system is that, users can invite sub-tier contributors once they have been added to a project. Meaning, if I am a project administrator and I invite you to join a new project – say the O'Toole project – you can then invite your employees or contributors thereafter. Now there are three tiers of contributing professionals: the project administrator, the second-tier working professional, and the third-tier. Permissions and security levels are controlled from the top down accordingly (see diagram on following page).

* **Project Administrator:** The top-level project administrator is - by default - the individual initiating a new project. The project administrator has complete and unrestricted access to the entire project database, and controls permissions and accessibility for all sub-administrators and project contributors.

** **Project Contributor(s):** Project contributors are contributing members of a given project that have been invited or added to a project by the top-level administrators. The degree or level of access to the overall project database given to project contributors is controlled and administered by the top-level project administrators.

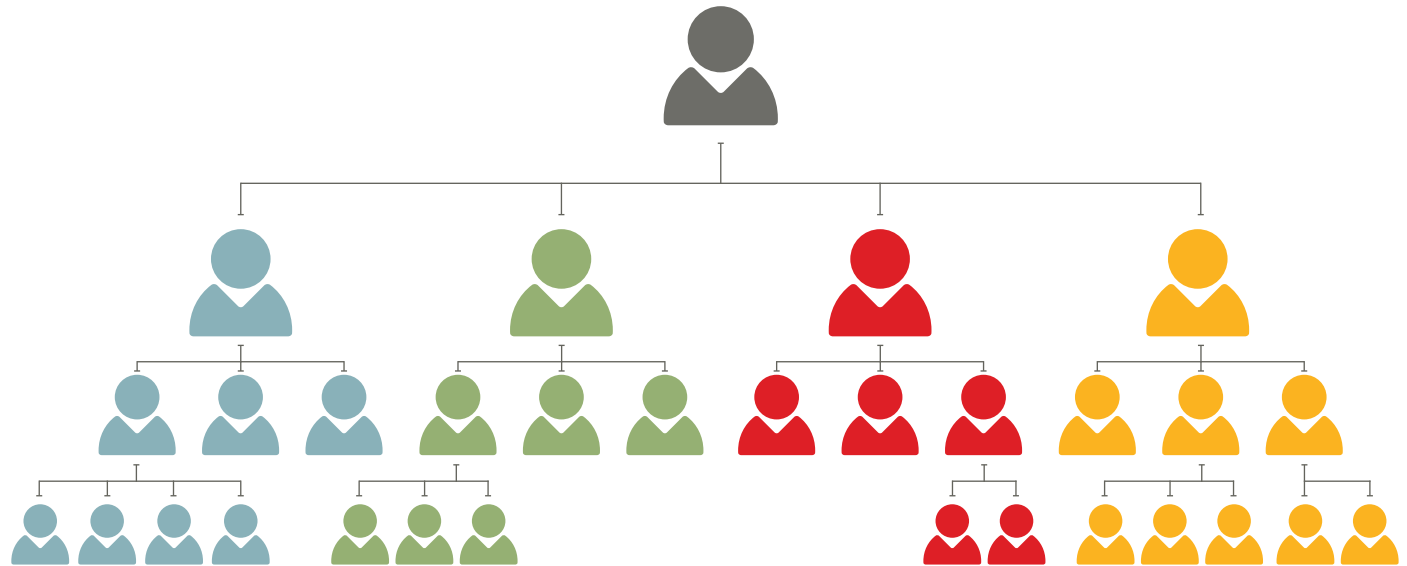
Project Administrator and Contributor Structure Diagram

Project Administrator
Professional who initi-
ates new project

**Project Office
Administrators**
Invited by top-level
administrator

Project Contributors
Invited by project
office administrators

Additional project
contributors invited
by higher-level users



Project Architect



Architects / Interns



Project Engineer



Engineers / Interns



Project Conservator



Material Scientists &
Conservators



Project Planner



City & Urban Planners
/ Historians / Heritage
Professionals

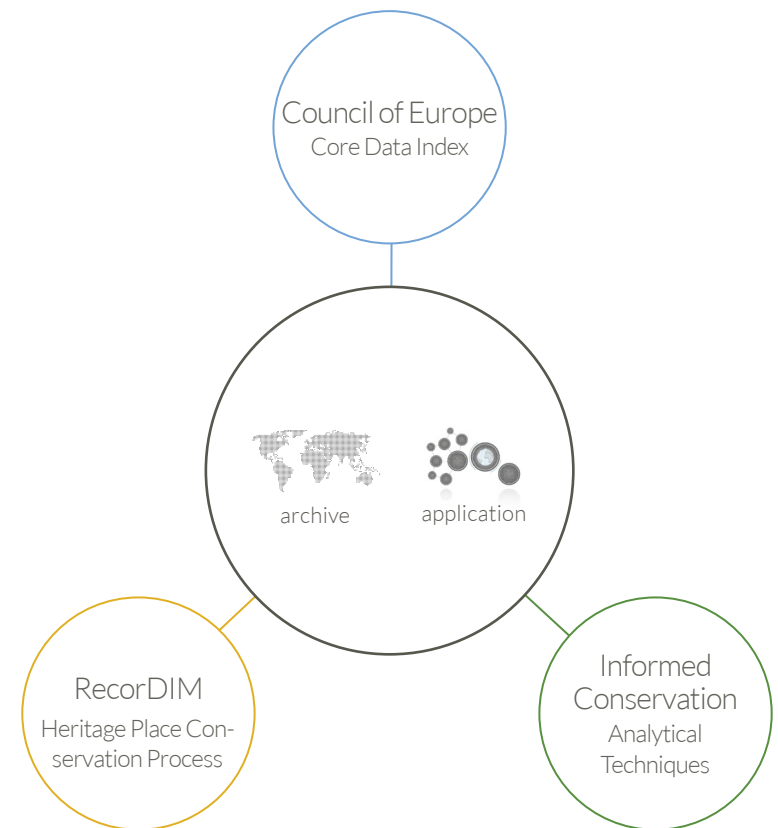
N levels



Six | Incorporated Standards & Final Thoughts

1) Incorporated Standards

The Heritage Project application incorporates the international recording and documentation standards published by the Council of Europe (*the Core Data Index to Historic Buildings and Monuments of the Architectural Heritage*), English Heritage (*Informed Conservation, Understanding Buildings and their Landscapes for Conservation*), and the Getty Conservation Institute (*Recording, Documentation and Information Management for the Conservation of Heritage Places: Guiding Principles*). Collectively, these three standards provide a flexible framework that is capable of handling an array of projects regarding the conservation of architectural heritage. They provide a viable method of project identification, they provide the basic taxonomies and project structure that can establish associative relationships between geographically and historically diverse projects, and they ensure that information and data, both collected and stored, represent the highest standards of the architectural conservation profession. The standards are incorporated into the application in the following ways: Project Identification, Interdisciplinary Collaboration and Project Phase and Document Management.



Standards and guidelines from supporting publications provide the underlying framework for *The Heritage Project* application.

Project Identification

The documentation standards and project frameworks are incorporated into *The Heritage Project* application as pre-defined list terms and project types (right illustration). When professionals begin a new project within the application, they are asked to fill out a series of brief forms to help identify essential components of the project (see illustration on following page).

These forms include data fields such as drop-down lists, check-boxes, radio-buttons and open-text fields (allowing additional text-based information when necessary). All of these input methods (with the exception of the open-text fields) are based on pre-defined sets of project terms and taxonomies that are derived from the standards developed by *The Core Data Index to Historic Buildings and Monuments of the Architectural Heritage*. In this way, professionals are guided by pre-set lists of terms and taxonomies derived from internationally agreed upon documentation standards, and if necessary, can include additional information via open text fields.

Physical Condition <div>Select One ▼ ?</div>	Building Use (Current) <div>(open text field)</div>
Project Type <div>Select One ▼ ?</div>	
Building Use (Current) <div>Commercial ▼ ?</div>	

Building Site Monument	→	<div>Adaptive Reuse Restoration Maintenance Preservation Other</div>	}	Project Type <div>Adaptive Reuse ▼ ?</div>
------------------------------	---	--	---	---

Open text fields provide additional information when pre-set lists and terms do not suffice. Information submitted via open text-fields are queryable via the site-wide and internet-wide indexing services.

Project Type	Location	Purpose	Organization	Organization Internal Project ID
B uilding M onument S ite O bject	Country, State , Postal Code, or GPS Coordinates.	C onservation D emolition R epurpose R estoration	Name or Description of Contributing Organization	Unique ID reference issued by contributing organization

Example:

Heritage Project Involving
Historic **B**uilding:

B-USACA92075-R-ICR-A512 or **B-d32Nm57s53-R-ICR-A512**

Latitude | Longitude OR Degrees,
Minutes & Seconds

M onument	M-USACA92075-R-ICR-A512	M-d32Nm57s53-R-ICR-A512
S ite	S-USACA92075-R-ICR-A512	S-d32Nm57s53-R-ICR-A512
O bject	O-USACA92075-R-ICR-A512	O-d32Nm57s53-R-ICR-A512

Project Identification: Creating the Project Reference Sheet & Identifying the Database

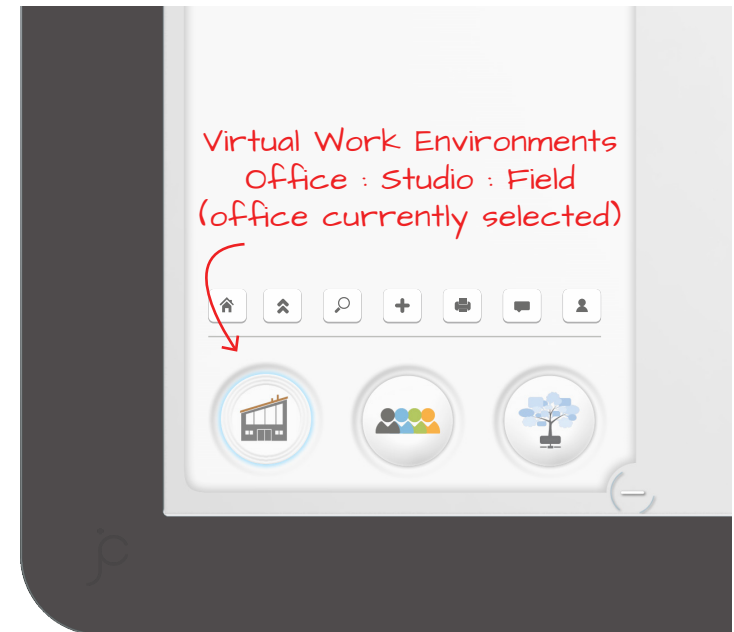
During the Project Initiation Phase, the project administrator is asked to enter essential identifying information that will later be used to create the project reference ID number and unique project database. The required fields include the project type, project location, purpose of proposed work, the name of the administrative recording organization, and the organization's internal project ID or reference number.

Interdisciplinary Collaboration

After completing the project initiation steps of *The Heritage Project* application, the professional enters the collaboration work environment where they decide who else they would like to include as project administrators and contributors. The professional starts by sending *invitations* to the other professionals involved (the architects, conservators, engineers, historians, etc.) who then receive invitations via email and can join thereafter. Once active, project contributors interact with the application through three separate work environments: The Office, The Studio and The Field (see top illustration at right and relational diagram on page 82).

The Office

The Office (bottom-right illustration) is the individual work environment set up for each of the contributing professions of the project (the architects, the engineers, the historians, the planners, etc). After the top-level Project Administrator invites second-level contributors, ideally the principal contributors from the architectural, engineering, historical, and construction industries, those second-level contributors are given their own virtual work environments where they can invite their employees or other relevant individual contributors to the project workspace. The Office environment has secure storage and viewing capabilities specific to the profession and professionals involved, and includes instant communication utilities, collaboration utilities, etc.



The Office

Files viewed from within "The Office" are private and can only be accessed by project contributors and administrators assigned to that specific work environment. For example, professionals from the Conservator's office cannot view files that are stored in the Architect's virtual Office work space.

The Studio

The Studio (top-right illustration) environment is the central work space, the central repository of project information, the centralized collaboration space in The Heritage Project application. The Studio can be thought of as the core collaboration center with individual office environments orbiting within the central studio space. The Studio includes all the collaboration utilities mentioned above in The Office environment, but includes additional public storage for all presentation documents (i.e., pdf, jpeg, video, audio, project schedules, budgets, contact lists, etc.), and presence indicators allowing users to see who else is online and available to collaborate with on project documents.



The Studio

Files that are marked Public (in the file or folder settings) are accessible by all professionals involved in the conservation project. These files can be accessed, viewed and edited from within “The Studio” virtual work environment. Files and folders found within The Studio environment typically include work schedules, photo surveys, project reports, presentations, etc.

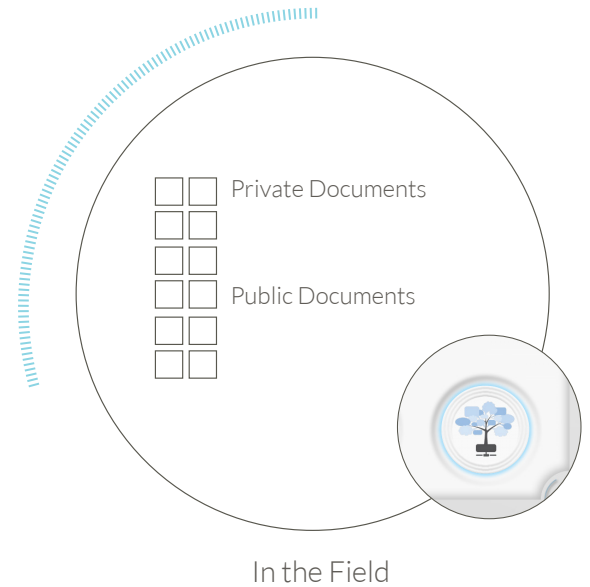
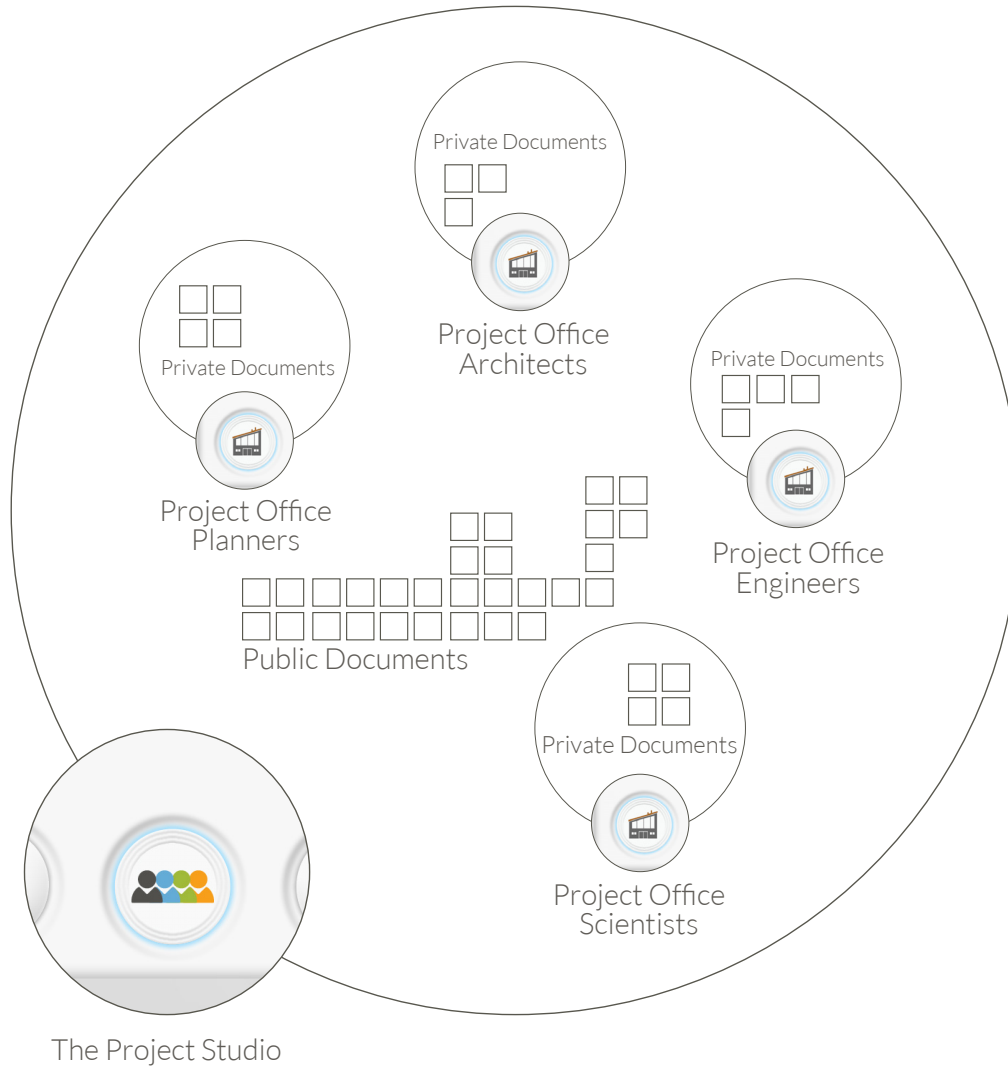
The Field

The Field (bottom-right illustration) environment is the virtual workspace that professionals can access when they are, literally, in the field. Through mobile computing devices, be it a smartphone or tablet-pc, the user can log into their project environment and begin to communicate with other professionals in The Office. Users operating within the Field environment of the virtual workspace can upload documents (images, videos, etc.) or can annotate drawings, take field notes or map conditions across an entire site. In situations where internet access is not available, which is often the case in architectural conservation project environments, the application may run locally on the device without being connected to the World Wide Web. Any field notes, annotated documents, or other forms of project media are uploaded automatically when ser-



The Field

Individuals interacting with the project workspace from “The Field” have access to specific documents that have been made available prior to field inspection. Professionals operating from within The Field may communicate with other currently active professionals within The Office or Studio work environments, and request additional documents or information if and when it becomes necessary.



Studio : Office : Field
Virtual Work Environment Relational Diagram

vice is restored, or manually synced with the in-office servers later on. Because all files and documents are stored both locally and within the cloud, professionals can access all centralized project documents when internet service is not available.

The Project Directories (File & Document Structure)

The project directories (file and folder structure - see illustration) are derived from the ideal output values of each phase within Letellier's Heritage Place Conservation Process. Default directories include Archive, Correspondence, Media, Notes, and Schedules. More specific folders within the master project directory correspond to the respective phase of the current project (see Master Project Directory diagram on the following page). Files and documents within the project directory are synchronized across all shared users and devices. Files and documents that are specified as public are shared with everyone; those specified as private are only shared with individuals within specified sub-groups (offices). Users can access their files either through the local application (running on their mobile device or personal computer), or through the online file-management interface.

This approach to project directories ensures that all users know which files are most current, where they are located, how they can be accessed, and allows for collaborative review of all presentation and final documents without confusion or miscommunication.

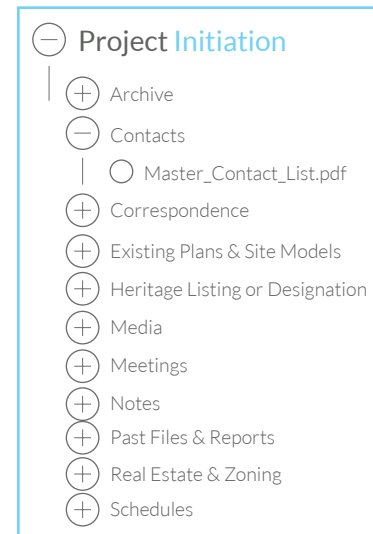


Illustration: Project Initiation default directory structure (diagram continues on following page).

Master Project Directory Structure

Project **Initiation** (Parent Directory)

Child Directories

- Archive
- Contacts
- Correspondence
- Existing Plans & Site Models
- Heritage Listing or Designation
- Media
- Meetings
- Notes
- Past Files & Reports
- Real Estate & Zoning
- Schedules

Project **Assessment** (Parent Directory)

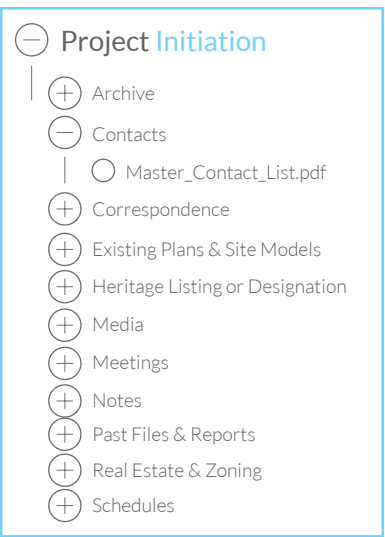
Child Directories

- Additional Reports
- Archive
- Condition Reports
- Correspondence
- Environmental Conditions
- Historical & Archaeological Surveys
- Material Analysis
- Measured Drawings
- Media
- Notes
- Schedules
- Scientific Investigation Data
- Thematic Maps

Project **Options** (Parent Directory)

Child Directories

- 3D Models
- Archive
- Correspondence
- Cost Estimates
- Detailed Drawings
- Expert Reports
- Media
- Notes
- Photographic Surveys
- Presentation Files
- Schedules
- Thematic Maps



⊕ Project **Assessment**

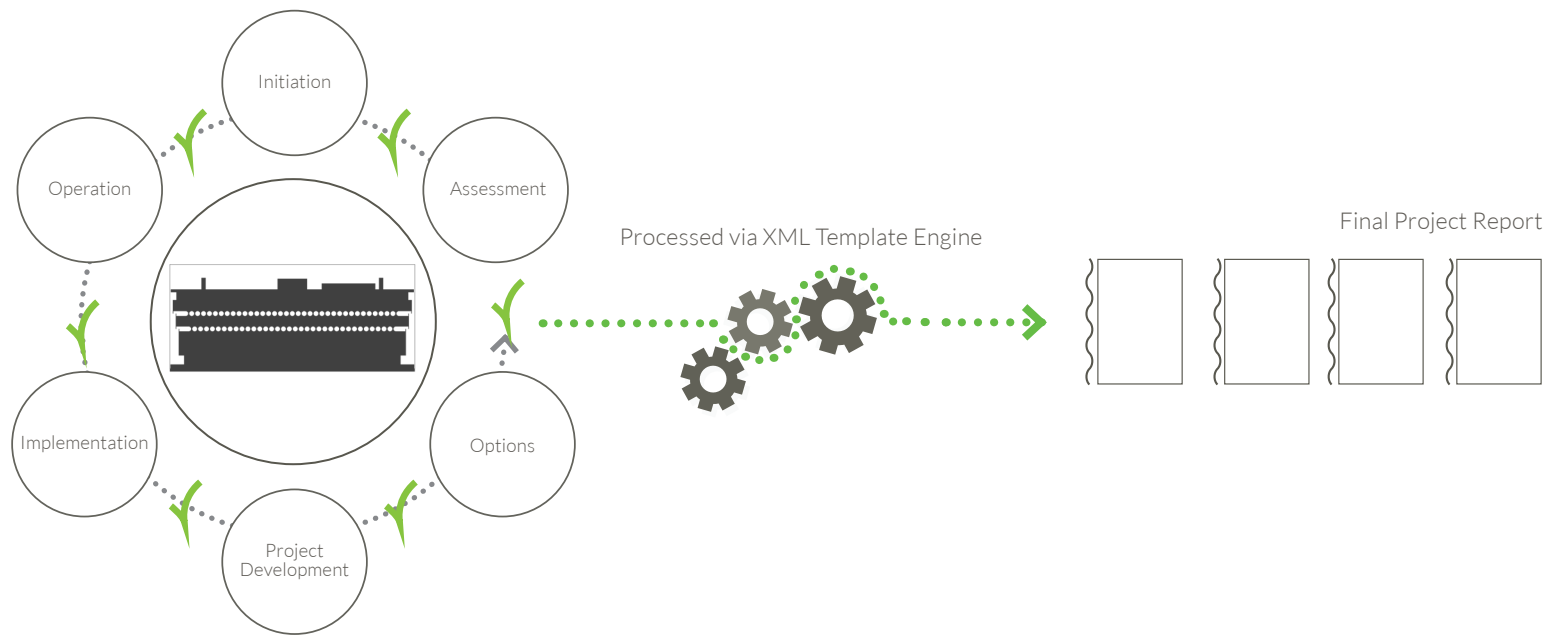


⊕ Project **Options**

Once the Initiation phase of the project is complete, the team moves on to the Assessment phase of the project through which they gain access to the assessment-specific phase directory. Once the Assessment phase is complete, the team moves on to the Options phase, and so on.

The Project Phases

The project phases are derived from the heritage place conservation process presented in the Getty Conservation Institute's *Recording, Documentation and Information Management for the Conservation of Heritage Places: Guiding Principles*. They include the Initiation phase, the Assessment phase, the Options phase, the Project Development phase, the Implementation phase and the Operations phase. Each of the phases require a certain level of information and understanding before the project team as a whole can move forward to the next phase of the project. The decision to move on or to continue working within a given phase, is made at the project administrators' discretion. Once a phase is complete, its documents and records remain accessible throughout all subsequent phases; when all phases are complete, and the administrator has signed off on the project, the information within the project database is processed and presented as a final project report (see diagram on following page).



Once a project is signed off, its contents are compiled and output as a final detailed report. Additionally, at any point in the project process, information in the central project database can be compiled and output as a pre-formatted progress or status report via an XML template engine.

2) Application Summary & Final Thoughts

The standards and guiding principles developed by the international heritage management organizations (presented in chapter three of this thesis) are incorporated in a very intelligent and systematic way to allow for a great range of flexibility within diverse architectural conservation projects simultaneously taking place around the world. At their core, the standards are still recommended guidelines (within a digitally accessible framework) for a best-practice approach to architectural conservation. When and where working professionals feel more descriptive terms or analysis is necessary for a given project, they have complete freedom to create new fields, populate open text fields, and upload files and documents of all sizes and types. The freedom to do so is invaluable to both attaining a greater understanding of international architectural conservation work as well as the successful integration of an internationally applicable program.

The wonderful thing about a cloud-based approach to data collection and project management, as it relates to architectural conservation, is its flexibility and international accessibility. By allowing professionals the freedom and choice to provide additional information about unique projects, the information within those projects becomes that much more meaningful. When this service is accessible via the World Wide Web, its applied potential and resulting benefits become limitless.

Furthermore, the most exciting benefit of using a user-friendly content-management-system to create and manage project content is that the end-user (the conservation professional) does not need to know exactly how the raw data is being stored or handled in the back-end mechanics of the program. For example, the conservation professional is free to choose from pre-determined lists of options, to fill out custom text fields, text bodies, or select years or genres of a building type and style. On the back-end, the content management system is recording this information in formats all computers and browsers understand; thus removing any responsibility and concern from the working professional. This approach allows professionals to focus on exactly what they need to focus on, without worrying about strict syntactic guidelines or data management protocols.

Ultimately, The Heritage Project application provides a starting point for professionals to establish relationships with other professionals from around the world taking the first step towards establishing an international inventory of architectural heritage information. It is, it always has been, up to the working professional to understand and appreciate architectural heritage so that they may in return ensure the passage of its significance to all those who follow. This is, after all, the fundamental purpose of architectural conservation.

Final Thoughts

As I stated in the introduction to this thesis, the cloud-based approach to data collection and project management is intended to help professionals take the first step towards a more productive and more efficient project management system that places the foundation for an international repository of architectural project information. What happens to the records once they have been collected and made available is unknown. However, by making it available to international communities today, in formats that are internationally recognized, we open doors to unforeseeable places for architectural professionals and researchers to explore on their own accord. While the benefits of this approach will become apparent over time, its immediate and transformative potential resides within the proactive utilization of cloud-based technologies.

On the surface, *The Heritage Project* application is a deployable tool to aid professionals in their collective efforts to conserve architectural heritage, to learn from one another and to proactively produce records for architectural professionals carrying out future work. But beneath the surface, somewhere between the PHP, HTML5 and jQuery programming languages, lies a response to an industry increasingly controlled by technologies that are largely misunderstood.

The World Wide Web is indeed a very powerful tool fueling the information age, but it is not so complicated that only select individuals should be able to understand the basic mechanics making its deployment and

application possible. As the global network of information systems continues to expand and have a direct impact on architectural professional's basic day-to-day operations, we at the very least have an obligation to understand what it is and how it works. In doing so, we grant ourselves the choice of whether or not we want to exploit the benefits associated with web-based technologies, rather than allow its blind-development to exploit resources few architectural organizations possess in the first place. Architectural professionals of any specialty or discipline, if they choose, can learn the material presented in this thesis just as I did, and in turn, develop their own web-based tools for architectural applications.

Appendix | Digital Back-end: Proof of Concept

The digital systems providing back-end system support for the front-end application is a combination of open-source web- and desktop-based application software, including: a content management, cloud collaboration, file browser, file management, file synchronization and social networking systems. These services are collectively provided by Drupal (<http://www.drupal.org>), Drupal API, Drupal Contributed Modules, Dropbox Inc. (<http://www.dropbox.com>), and the Dropbox Developer API. The underlying open-source object-oriented, scripting (server-side & browser), database, styling, hyper-text programming languages and web-server include: PHP, Ajax, JavaScript (jQuery), Python, MySQL, CSS3, HTML5, and the Linux Apache Web Server, respectfully.

The server architecture supporting the front-end application and interface is a proprietary configuration of Linux Ubuntu 12.04 Precise Penguin, NGINX and Apache2 web-server, MySQL relational database platform, MongoDB document-oriented database platform, Apachesolr Indexing service and PHP Memcache, Curl, GEOS and Mongo libraries. This particular server configuration is designed very specifically to

handle server requests by many individual users at any given time. The use of both a relational database management system (MYSQL) in addition to a document-management system is primarily for security and stability, and secondarily for speed and performance of cached-document handling, reducing the dynamic loads on the MySQL database and the NGINX and Apache web-servers. The PHP libraries add additional functionality required by front-end application.

The software utilities and content management systems discussed in this section comprise the technical foundation from which *The Heritage Project* web- and desktop-application is conceptually constructed. Because *The Heritage Project* application is designed to run entirely on open-source platforms, development and operational costs are kept to a minimum. Once the program is constructed and configured using these resources, its on-going operation may easily be monitored and updated by select groups of knowledgeable AEC professionals who are willing to explore the unknown boundaries of architectural conservation, cloud-based computing and information technology.

Glossary

Architectural Heritage - The collective ensemble of existing buildings, both the celebrated and the ordinary.

Building Information Modeling (BIM) - BIM software applications (such as Autodesk's Revit Architecture, or Graphisoft's Archicad) allow users to design and build central project models in both three- and two-dimensional space.

Conservation (Source: RecorDIM) – A discipline concerned with the transmission of cultural heritage, with its significant values intact and accessible to the greatest degree possible.

Conservation Process (Source: RecorDIM) – The informed decision-making process, which ensures that conservation at all levels will respect the values and significance of the cultural heritage place.

Conservation Professionals (Source: RecorDIM) – Those who, whatever their profession, trade, or discipline of origin (art historians, architects, archaeologists, conservators, planners), engage in the practice of

conservation and are committed to the application of the highest principles and standards of the field.

Cloud Collaboration – The approach to multi-user collaboration that utilizes cloud storage and computing technologies to share and co-author computer files.

Content Management System – Allows publishing, editing, and modifying content as well as site maintenance from a central page. It provides a collection of procedures used to manage work flow in a collaborative work environment.

Crowd Sourcing - Within the context of information technology, crowd sourcing is the process of utilizing individual users on the World Wide Web for the purposes of data production, collection, management and analysis. The term Crowd in this sense is used loosely, as it implies a great range of potential individuals (several thousand to several million).

Data (Project) – Project data refers to the collective inventory of project data / information coming from a given project. It includes raw project data and processed project data. The collective project data inventory is usually a final collection of processed and raw data and is presented in the form of a final project report.

Data (Raw) – Raw project data refers to any information that exists within from building, site or landscape. Raw data is not processed or manipulated in any way.

Data (Processed) – Processed project data refers to project information

that has been extracted from a building, site or landscape and has been processed or manipulated for the purposes of presentation, understanding or other relevant purposes. Processed data may take the form of construction drawings (dwg or pdf formats), image presentations (jpeg, png, gif, tiff, pdf), etc.

Database – A source of collected data. The data are typically organized to model relevant aspects of reality in a way that supports processes requiring information within the collected data. There are many sub-definitions of the term database, including but certainly not limited to: relational databases, database management systems, logical databases, physical databases, automated databases, spatial databases, etc.

Database Management System (DBMS) - A DBMS provides the ability for many different users to share data and process resources. A DBMS provides three views of the database data: external view, logical view and physical view.

Database table – Tables contain managed sets of data and information within a parent database.

Digital Recording Methods – Digital recording methods refer to any method of field recording or documentation that is collected through digital devices. Digital recording methods include photographic surveys, EDM surveys, laser scanning, ground-penetrating radar, etc.

Directory (Folder) - A folder directory is a digital storage device that handles folders containing additional folders and files of varying formats.

For example: C:/My Documents, or C:/Users/PJC/WAMP/WWW/the-HeritageProject/index.php.

Dropbox Inc. – A web-based hosting service that uses cloud storage to enable users to store and share files and folders with other users across the internet using file synchronization.

File browser (AKA File Manager) – A file browser is a graphical interface displaying the contents of a file or folder directory. File browsers typically have navigation windows next to a document display window. The most common operations performed on files or groups of files are: create, open, edit, view, print, play, rename, move, copy, delete, search/find, and modify file attributes, properties and permissions.

File synchronization – File synchronization is the process of synchronizing the contents of a single file, folder or document stored in two or more different locations. Most file synchronization utilities available today provide revision history, event history and additional collaboration utilities.

Heritage place – Heritage place refers to any building, site or landscape relevant to the cultural heritage.

Heritage place conservation – Heritage place conservation refers to the conservation efforts relating to the physical preservation of heritage places. Heritage place conservation includes ensuring structural stability of historic structures, repair work (minor and extensive), adaptive reuse projects involving heritage places, etc.

Heritage-place project-management-system - A robust web-application that facilitates communication amongst working professionals, handles and serves important project documents, defines project schedules, keeps project records, etc. *The Heritage Project* management system mediates a broad reciprocal relationship between working heritage professionals and global heritage archives, assisting in information management and coordination methods of local project activities, in exchange for the collection of essential bits of project information for the purposes of building the global archive.

Heritage project inventory – Heritage project inventory is a collection of heritage project databases.

Heritage project database (Architectural Project Database) – A heritage project database is the collection of all information and data produced from a given heritage conservation project. The project database includes information regarding the organizations working on the heritage place, the internal and external stakeholders involved in the heritage place project, the legal documents produced throughout, any and all scientific reports / analysis regarding the physical characteristics of the project, design documents, engineering documents, architectural documents, public documents, etc. *The Heritage Project* unique project-database is the central repository of all project data and information collected before, during and after a heritage place project.

Heritage project process (Source: RecorDIM) – The informed decision-making process, which ensures that conservation at all levels will respect

the values and significance of the cultural heritage place.

Heritage Recording (Source: RecorDIM) – The graphic and/or photographic capturing of information describing the physical configuration, evolution, and condition of a heritage place at known points in time.

Information Management (Source: RecorDIM) – The process of finding, cataloguing, storing and sharing information by making it accessible to potential users now and in the future.

Information Units (Source: RecorDIM) – Partial information (or records) produced by individuals at different stages during a conservation process. It refers to the output of both conservation professionals and heritage recorders.

Open Source - The Open source [software] business model “promotes free redistribution and access to an end product’s design and implementation details” - <http://www.opensource.org>. Open source software is free in the sense that users of open source software may view and amend the source code of a given program without charge or penalty. For more information regarding the history and development of the Open Source Model, visit <http://www.opensource.org>.

Traditional Recording Methods – Traditional recording methods refer to methods of collecting, recording and managing information from heritage place projects that utilize non-digital methods of recording, i.e., hand sketch, written reports, non-digital approach to field, building, or site survey.

Record – (1) The products of recording activities. (2) Any object, artifact or document produced which contributes to the historic record and can be referenced by future generations.

User generated content – A term used to broadly define types of content produced by users contributing to online communities. Types of user generated content include discussion boards, blogs, wikis, social networking sites, photo & video sharing sites, etc.

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